WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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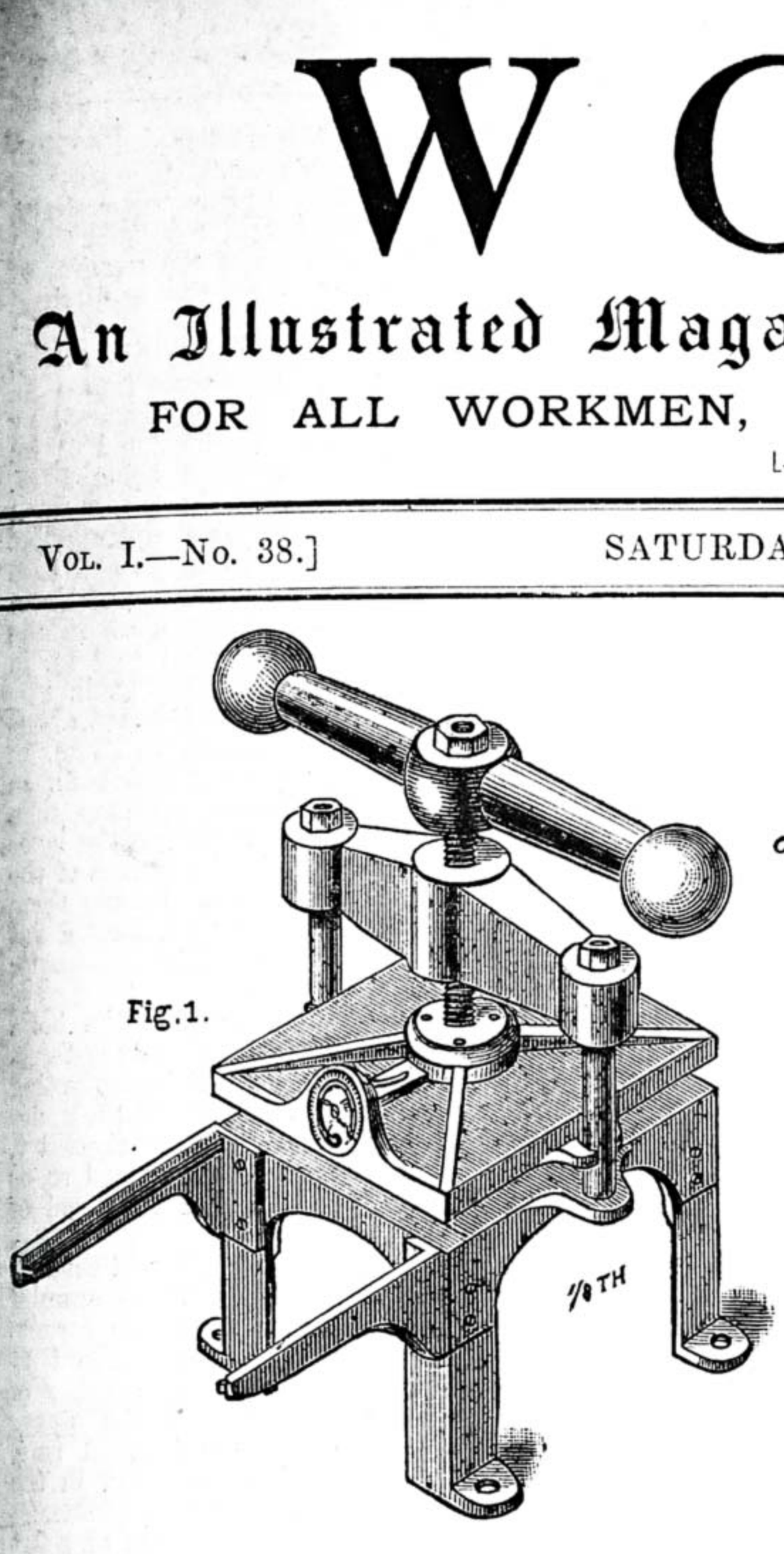
Fig.1.



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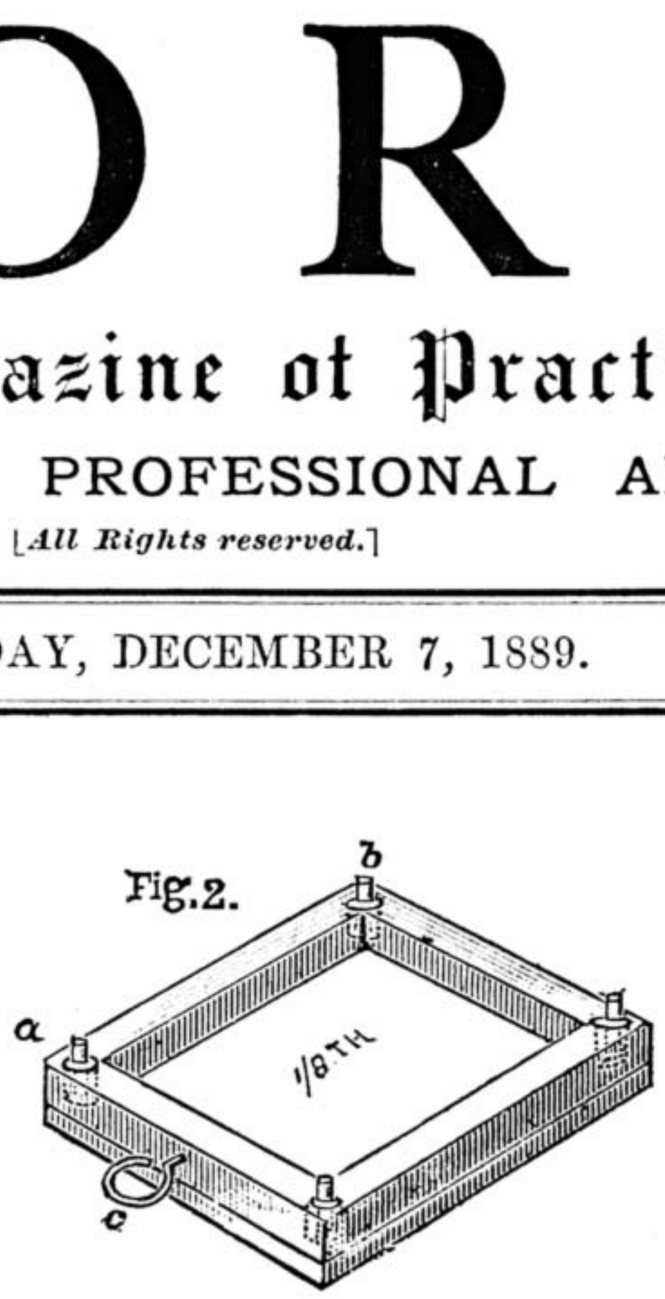

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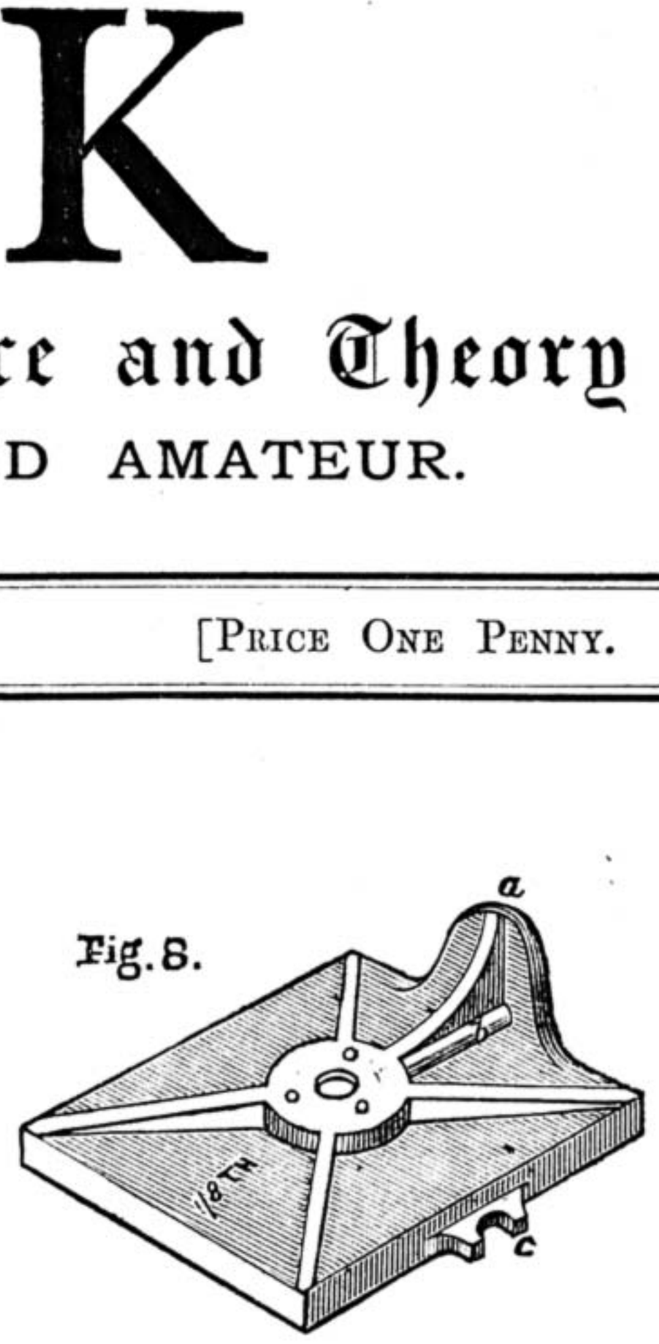

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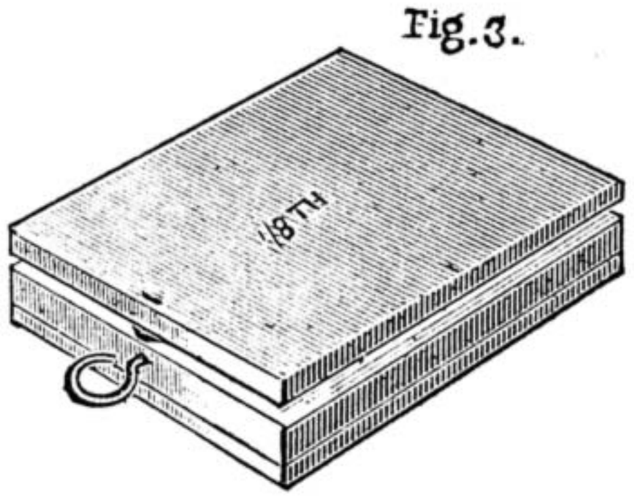

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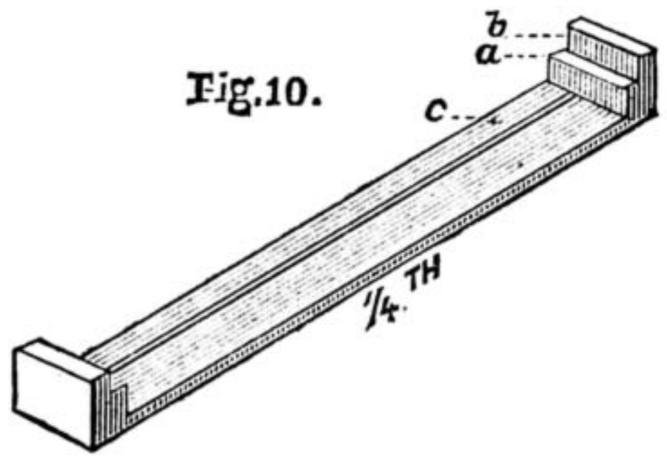

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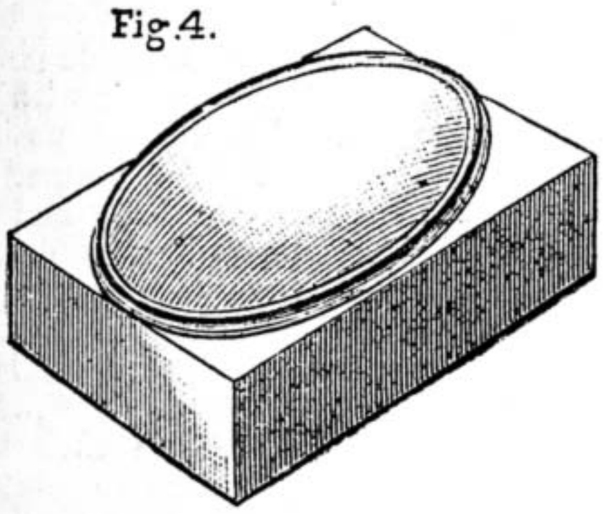

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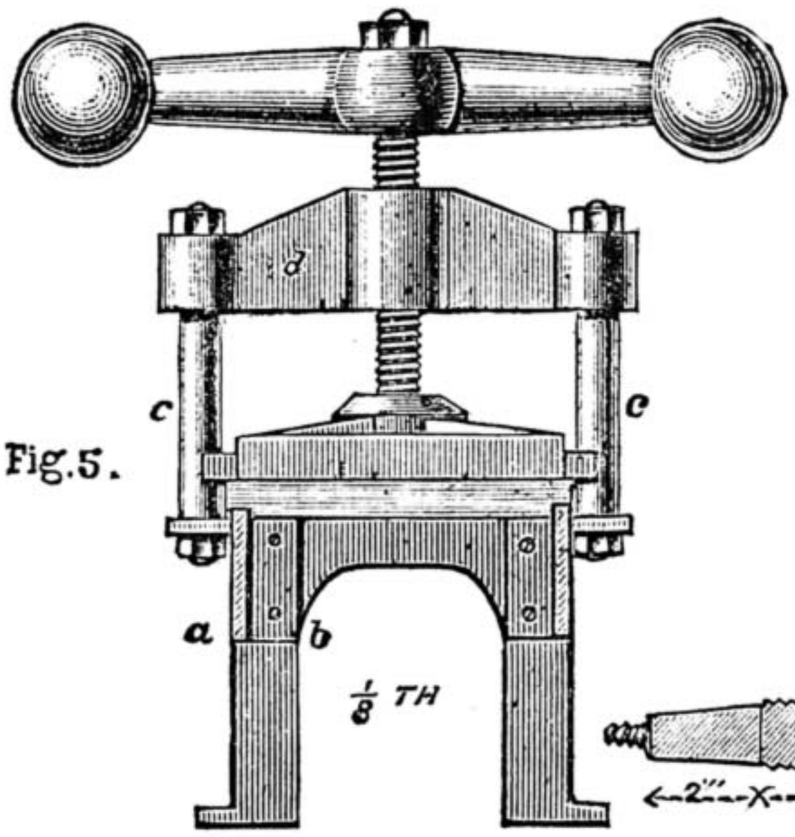

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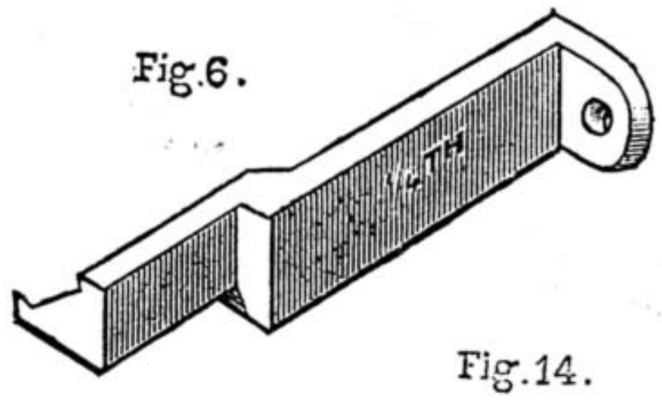

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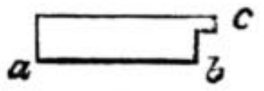

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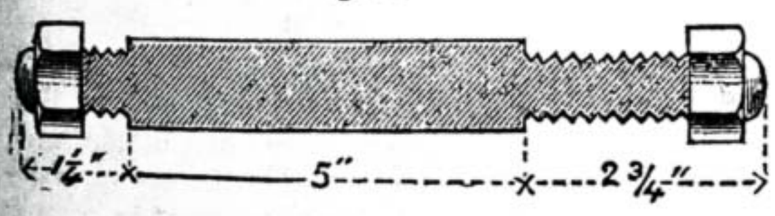

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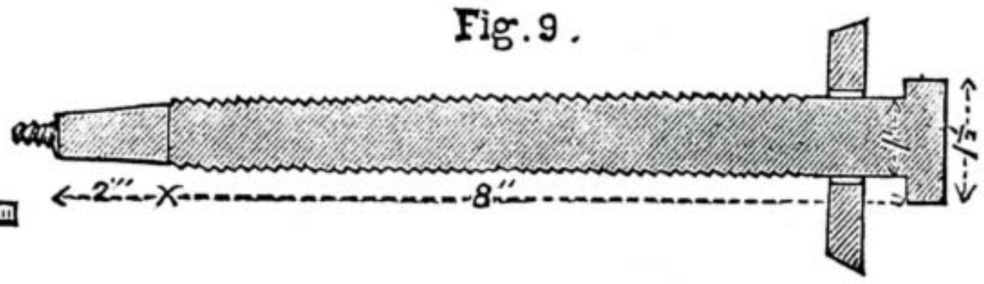

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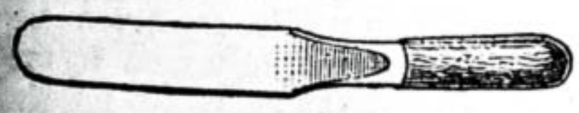
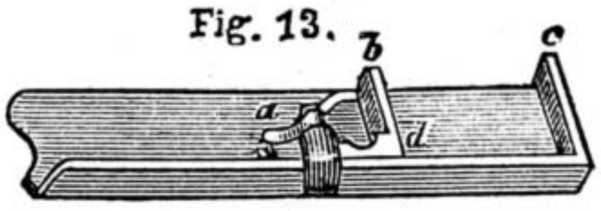


Fig. 12.

Fig. 13.



INDIARUBBER STAMP MAKING. (*For Description see next page*). **Fig. 1.—Press for Moulding and Vulcanising. Fig. 2.—Spring Chase. Fig. 3.—Chase with Moulding Plate in Position. Fig. 4.—Oval Shape. Fig. 5.—Elevation of Press. Fig. 6.—Leg of Press. Fig. 7.—Section of Standard. Fig. 8.—Platen or Follower. Fig. 9.—Section of Main Screw of Press. Fig. 10.—Moulding Gauge. Fig. 11.—Palette Knife. Fig, 12.—Side Stick. Fig. 13.—Composing Stick. Fig. 14.—Setting Rule.**

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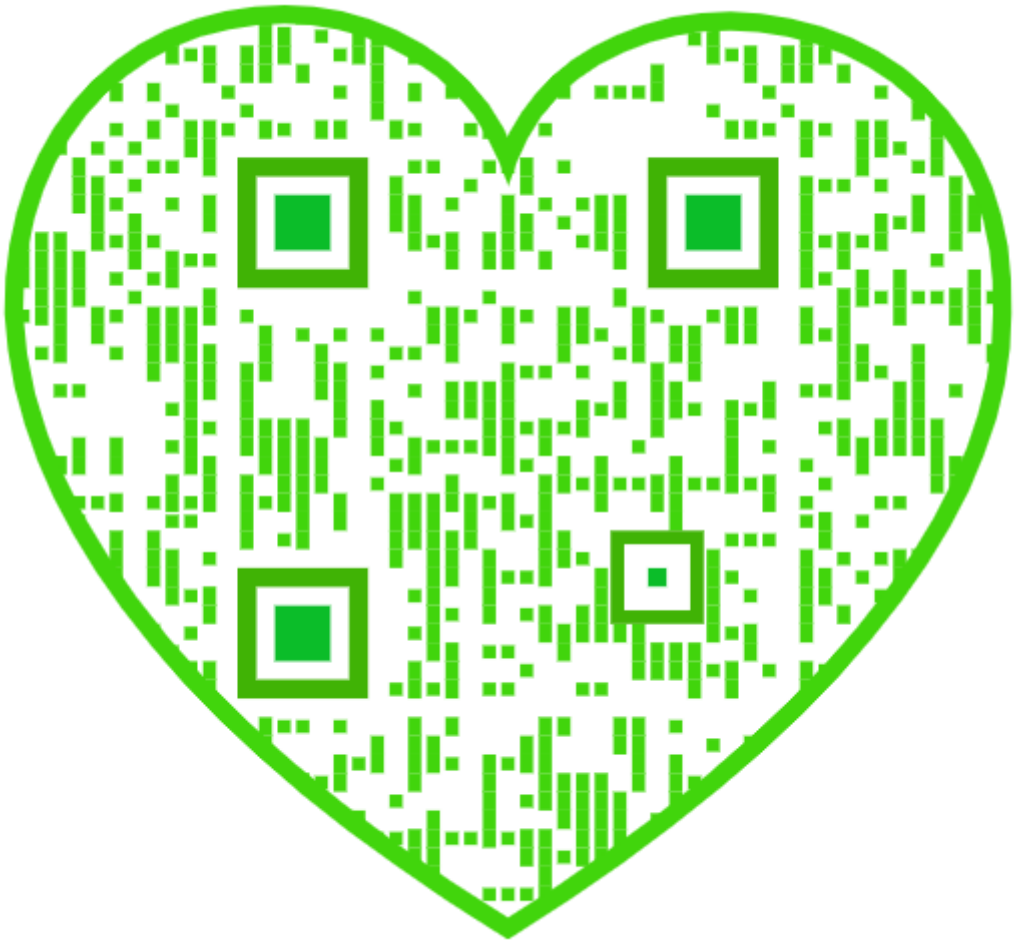

INDIARUBBER STAMP MAKING.

BY "QUI VIVE."

INTRODUCTORY.

IN these "go-ahead" days, when almost anything which promises to aid in the economy of time is eagerly welcomed, notwithstanding the fact that many of the most alluring promises are of the proverbial "pie-crust" kind, no excuse is needed for introducing the subject of rubber stamp making. Few offices, even of the most humble pretensions, are to be found without their complement of indiarubber stamps; and even in private life these extremly useful articles have won golden opinions, if one may judge from the numerous advertisements of monograms, linen-markers, note headings, etc. etc., which meet his eye in the periodicals which come under his notice.

The purposes for which india-rubber stamps may be advantageously used are almost numberless, and these handy instruments may be fairly regarded as valuable auxiliaries to the printing press, having their own special sphere of usefulness into which the printing press cannot profitably enter. For the purpose of repeating impressions of the same matter at irregular intervals and in varying situations the solid die has long stood in high favour, and, in the form of the now old-fashioned brass endorsing stamp, is still to be found occupying an honourable position. I am, however, inclined to the opinion that the introduction of indiarubber stamps struck a blow at the older instrument from which the latter cannot possibly recover, the rubber die being not only capable of doing any kind of work for which its predecessor was used, but having also the immense advantage of *elasticity*, by which it is enabled to adapt itself to surfaces so unlevel as to render the use of a rigid metal die altogether out of the question.

When a person handles a well-made indiarubber stamp for the first time, he is, if of an inquiring turn of mind, led to ask by what mysterious process such an apparently intractable substance as indiarubber has been made to yield such beautiful results, and his wonder does not cease if he is fortunate enough to elicit the information that rubber stamps are not engraved but moulded. Indiarubber stamps are not—indeed *cannot* be—made of pure rubber, but of a mixture of pure rubber and sulphur; the mixture being forced into a suitable mould by strong pressure, and in that state submitted to such a degree of heat as will bring about a chemical union of the sulphur with the rubber, and thus produce what is known as *vulcanised* rubber.

The essentials of an indiarubber stamp making plant, then, consist of some means of producing the requisite moulds, and afterwards applying pressure and heat simultaneously to the rubber compound placed therein.

Various attempts have been made to beguile the confiding amateur by offering "complete apparatus and full instructions" for the manufacture of india-rubber stamps, all of which have hitherto been of the nature of the conjurer's explanation of his astounding tricks. I do not, by this statement, intend to convey the idea that satisfactory rubber stamps cannot be produced by such apparatus, for I have personally made some very satisfactory stamps in this way; but, as a matter of fact, chance or good luck enters very largely into the case, and the amateur who succeeds in making a stamp *that will stand the test of hard wear* once out of every twenty trials may be considered exceptionally fortunate in his experience. I purpose in these papers giving such instructions as will enable any person of ordinary intelligence who carefully follows them, to produce stamps equal to any sold by professional makers, and if by inadvertence any point should be overlooked, or the details not made sufficiently clear, a query addressed to me through the Editor will receive due attention in "Shop."

APPARATUS.

The apparatus which I am about to describe is adapted for the production of stamps up to six inches by four inches, a size which will probably suffice for most of my readers; but if any require apparatus of a larger size, corresponding additions to the horizontal dimensions given will be all that is needful. The apparatus consists of, (1) printing types and "shapes" of various kinds, according to the fancy of the stamp maker, and a few printers' sundries as detailed below; (2) a specially adapted "chase" to hold the type rigidly during the process of moulding; (3) a moulding plate on which to form the mould and retain the same during the subsequent process of vulcanising the rubber; (4) a moulding-gauge, by the aid of which the moulding composition is spread upon the moulding-plate in a thin and even layer, and (5) a press suitably arranged for use both in forming the mould and afterwards as a vulcaniser. These various pieces of apparatus we will now proceed to consider in order.

1. *The Printing Type and Shapes.*—These may be obtained of almost any printer's broker or type-founder. It is the best plan to confine one's selection to plain type—*i.e.*, type without shading or ornamentation—as, although the finest detail is faithfully reproduced by the rubber, the fine lines soon become choked with ink, and the stamps rendered practically useless. The "shapes" in common use are mostly oval in form, as shown full size in Fig. 4. They may be either solid brass or electrotyped, the latter being the cheaper, but the former the more useful and lasting. "Fancy" shapes to be used in conjunction with type are generally electrotyped, and in this form are substantial enough for the more limited use to which they will probably be subjected.

A supply of "quads" and "spaces"—blank pieces of metal of various thicknesses, and of widths corresponding to the type with which they are to be used—should be purchased at the same time as the type; also a couple of pounds of 4-to-pica "leads"—thin strips of type metal for separating the lines of type—and two or three lengths each of narrow "furniture," pica and non-pareil "reglet," pica "wood rule," and thin "brass rule." A "composing stick" (Fig. 13) will also be required. "Side sticks" (Fig. 12) may be either purchased or made at home. They are tapering pieces of hard wood, generally oak, which are used in conjunction with "quoins"—similar tapering pieces of wood about 1½ in. in length—for firmly securing the type, etc., in the chase, described below, during the process of moulding. It is recommended that both side sticks and quoins be made in the following manner:—Carefully plane up a strip of oak 2 ft. in length, 1¼ in. wide, and ⅝ in. thick, taking care to have the corners square; then divide this parallel strip into two tapering ones, ⅞ in. wide at one end and ⅜ in. at the other, and plane up the newly-sawn edges square and true. Now cut off four 1½-in lengths from the smaller end of each strip, and divide the remaining portions into 4½-in. and 6-in lengths respectively, and we have a supply of side sticks and quoins, which only require the removal of the rough edges left by the saw to fit them for use.

2. *The Chase.*—This is shown in Fig. 2, and consists of a plate of cast iron ⅜ in. thick, planed on both sides, surmounted by a strong iron frame 7½ in. long and 5½ in. wide inside, the frame itself being ⅞ in. wide and 1 in. deep, with the top, bottom, and inside planed true and square. At each of the corners of the frame and base plate a $\frac{5}{16}$-in. hole is drilled through from the top to the bottom, the holes in the frame being then counterbored to ⅝ in. in diameter for ¾ in. in depth (see Fig. 2).

Four pins are then made of ⅜-in. rod, about 2 in. in length, and reduced to $\frac{5}{16}$ in. in diameter for rather more than ⅝ in. in length at one end. These pins are then riveted by their smaller ends into the holes which have been made in the corners of the frame and base plate, thus riveting them together and forming a tray having a flat bottom with the four sides at right angles thereto and to each other.

Before riveting in the pins the holes in the base plate should be slightly countersunk on the underside, and when the riveting has been satisfactorily completed the under surface should be filed level if necessary, and the free ends of the pins reduced so as to project barely ⅜ in. above the level of the frame of the chase.

Four open spiral springs of steel wire $\frac{1}{16}$ in. thick are then fitted to the annular spaces around the springs in the corners of the chase, these springs being about 1¼ in. in length when open, but capable of being compressed level with the upper surface of the frame of the chase. A ring, *c*, is made of ¼-in. rod and screwed in the front edge of the chase to form a handle.

3. *The Moulding Plate* consists of a flat plate of iron, identical with that used for the base plate of the chase, with the exception that the holes in the corners are to be of such a size as will allow the guide pins in the chase to pass freely through with the least possible play. The correct position of these holes may be best secured by clamping the frame of the chase and the moulding plate together, and then drilling ⅜-in. holes through the moulding plate and sufficiently far into the chase frame to serve as guides for subsequently drilling the holes proper to the chase and base plate, which should be clamped together in their turn and both drilled through at one operation. If this operation be properly done, the holes at each corner will exactly correspond, and a very little "easing" of the holes in the moulding plate by means of a reamer will afford sufficient play. The moulding plate in its working position on the chase is shown in Fig. 3. When properly fitted together some distinctive mark should be placed on the front edges of both chase and moulding plate, so that no time may be lost in fitting them together subsequently, when the least delay may be fatal to success, and cause the whole operation of moulding to be commenced anew. Before proceeding further with my description, let me say that the fitting of this part of the apparatus cannot be too carefully performed if the best results are expected.

4. *The Moulding Gauge* is formed as shown in Fig. 10, and may be made of either brass or iron, the former being preferable, not only because of its being readily cast from a

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pattern, so as to require but a small amount of finishing, but also on account of its freedom from rust. It is made to ride by the seat *a* close to the edge of the moulding plate, on which it is retained by the guards *b*. The edge *c* is so adjusted that when placed in position on the moulding plate it will leave a clear even space of from $\frac{1}{12}$ in. to $\frac{1}{8}$ in. between itself and the plate.

5. *The Press.*—This is shown complete in Fig. 1, and is somewhat similar to an ordinary letter-copying press. It is, however, necessarily of much more massive construction than copying presses, so that it may be able to retain an approximately equal temperature during the process of vulcanisation. The table and platen, or follower, are each 9½ in. from front to back, 8 in. wide, and 1 in. thick, with their opposing surfaces planed true. Dwarf standards $\frac{3}{8}$ in. thick depend from the corners of the table to the depth of 2 in. below its under surface, the width *a-b* in the elevation (Fig. 5) being 1½ in. To these are screwed legs 4½ in. in length as shown in Figs. 1 and 5. Fig 6 shows the leg in its entirety, and clearly indicates by what means it is attached to the table. The position of the feet, of course, varies as required by the position of the legs. Projecting lugs on the sides of the table support standards of round iron as shown in section in Fig. 7, in which is also shown the dimensions of the standard. These standards are mounted 9½ in. apart from centre to centre, and midway between the front and back edges of the table. The platen, shown separately in Fig. 8, is formed with a central boss 3 in. in diameter, in which is formed a circular cavity 1½ in. in diameter and ½ in. deep for the reception of the head of the main screw, which, with the collar by which it is attached to the platen, is shown in Fig. 9. For the sake of appearance, ribs are made to radiate from the central boss to the corners of the platen. The projection shown at *a*, Fig. 8, is for the attachment of a thermometer, the bulb of which is to be inserted some 3 or 4 in. in a hole drilled lengthwise in the thickness of the platen, which may, if necessary, be made thicker at this part, as shown at *b* in the figure, the diameter of the hole being regulated by the size of the thermometer bulb. From $\frac{3}{8}$ to $\frac{1}{2}$ in. will, however, be large enough. The thermometer may, with advantage, be of the form known as an "oven" thermometer, the external appearance of which is shown in Fig. 1. It is attached to the platen by means of a small central screw, the bulb and that portion of the tube which is at right angles to the circular scale plate being inserted in the hole drilled for their reception. Midway in the length of the platen is placed, on each side, a guide-piece (*c*, Fig. 8), which, partially encircling the standard rising from the table, prevents the platen from twisting when raised or lowered by the screw. The standards (*c*, Fig. 5) are connected at the top by a crosshead, *d*, through the centre of which is formed a female screw to act as a nut to the main screw, which is threaded with not less than 8 threads per inch. Motion is conveyed to the main screw by a weighted lever, as shown, the lever being fitted to a tapering square on the end of the screw.

Brackets affixed to the front of the press, as shown in Fig. 1, will be found very useful to support the chase, etc., from time to time during the preparation of the mould, and also to support the mould whilst being dried.

Having now described the necessary apparatus, I will leave the reader to construct this before proceeding to describe the mode of working, which I will do in another paper.

ENGRAVING ON METAL.

BY NORMAN MACLEAN.

Engraving on Brass and Zinc.

Engraving on brass includes door and window plates, memorial brasses, axle caps, saddlery mounts, beer engines, fender and fire brasses, etc. It is executed in two ways: for small and moderate-sized work with the graver in the usual manner, and for large work by means of the hammer (Fig. 22) and chisel. The latter process requires a greater outlay for outfit, but with this advantage, that the chisel will remove enormous quantities of metal in a very short time, which is, however, counterbalanced by the very great noise made in the operation, which renders the process unfit for home work.

For this reason many engravers prefer to cut the whole with the graver, and, certainly, more correct work can be done, even if it takes a longer time. It will be seen that the outfit for name-plate work includes some extras not required by the ordinary engraver, and possibly some workmen may have tools by them which by a little ingenuity can be utilised for brass engraving.

Brass plates may be obtained at a metal dealer's, cut to size, at the rate of 7d. per pound. They are not flat, and require hammering by a silversmith before they can be engraved. They should also be sand-buffed or rough polished on one side only. After having been made flat by the silversmith, true up the edges (and bevel them if required), using leaden clams in the vice to prevent unnecessary marks, and using the square and straightedge freely during the process. Then send it to be rough polished on one side only. If you prefer to do this yourself, procure a large piece of pumice-stone and plenty of water, and rub the plate (always in the same direction evenly all over the surface) till every scratch is removed. Finish with a large piece of water of Ayr stone, when you will have a fine surface to cut upon.

Now mark out the border, if one is desired. The border is generally a single line with the corners finished ornamentally, the said line and corners cut deeply to hold the wax. Having decided what style of lettering you will adopt, mark in the name with the pencil. To do this proceed as follows: Draw with the pencil a line down the centre of the plate, and also one across the centre of the plate; next count how many letters are contained in the name. Take the centre letter of the top line and roughly sketch it in midway between the centre pencil line and border. Continue to sketch roughly in the remaining letters each side of the centre until they are pretty evenly balanced. Now rule with the straightedge and point (Fig. 23) a line at the top and bottom of the roughly sketched in name, and proceed to draw carefully the whole name, seeing that each letter has plenty of room to stand in, and that the name itself is well balanced on the plate. A few words about the style of lettering for door plates. They should be very legible, and perhaps the best styles for this work are "block letters" and the "Italian," or "writing." I can illustrate my meaning by a little anecdote. At a well-known engraver's in this town there was, and is now, to be seen a large brass plate, with the name and trade of the owner engraved in the highest style of the art. On one occasion I was coming along past this brass plate, when I was stopped by a man carrying a large basketful of work, and who asked me to direct him to Mr. M——'s. (I had noticed the man looking at the plate as I came along the street, and had half suspected that he could not make out the lettering). "Why," said I, "you are looking at his name plate. That is Mr. M——'s place of business." "Well," said the man, "I have seen some thousands of door-plates, but I never came across one that I could not read in my life. This *beats* me." This plate was done in three styles; the name was ornamented Roman, the middle line in German text with flourishes, and the bottom line in Gothic lettering, and not at all easy to read.

The workman, having the plate properly set out in pencil, can now "point it in," using the steel point (Fig. 23). Use the rule for all straight and angular lines, and the dividers and rule for parallel lines, and keep the "block letters" upright, and the "writing" at a moderate angle. The sizes of brass plates vary greatly, from a small plate 4 in.×2 in.×$\frac{1}{8}$ in., bearing the words "push," "ring," "knock," etc., to door plates 18 in.×12 in.×¼ in., and it is in engraving these large plates that chisel work comes in with advantage. The plate being "pointed in" ready for cutting, it will require to be mounted on the stone with cement. Before pouring the hot cement on the stone, brush off all the dust and sand that may be adhering to it, and place it before the fire to be thoroughly warmed through, then warm the plate, and lay it on the hot cement, pressing it down so as to make it solid to work upon. This will deaden the sound of the hammering, and resting the stone on the large sandbag will further deaden the sound, counteract the effect of the blows on the chisel, and enable the engraver to turn the work in any required direction (Fig. 21).

In order to outline the letters the operator must first take the chisel (Fig. 25), and whet it at a rather acute angle, and "set off" at about 30°. Commence with the perpendicular lines; outline them boldly as regards depth, holding the chisel slightly sideways, so as to "undercut" the letters. "Undercutting" makes the letter or figure slightly larger at the bottom of the cut than at the surface, and therefore holds the wax more securely. Having cut all the perpendicular lines in one direction, turn round the block and recut the same lines in the opposite direction; this will make the corners square. Then cut the cross lines in like manner. The straight lines will be much more easy to cut than the curved ones, so, until the workman has obtained full command of the chisel, he will do well to cut the curved lines with the graver. The outlining being done, take a chisel nearly the width of the lettering, and proceed to sink the letters to the depth of one-sixteenth of an inch (Figs. 26 and 27). Leave the bottom of the cut as rough as possible, as it tends to hold the wax. This being done, take the scraper (Fig. 24), and remove the "burr" or "fash" thrown up by the action of the chisel. Now take an ordinary graver with a wide facet, and square up the corners, and give a graceful outline to the curves. If the plate is to be mounted on a mahogany block, the four screw-holes must now be drilled and countersunk, which the workman can easily do with the handy Archimedean drill; but if the plate is to be put upon a door, it will be required to have soldered on the back two bolts, which will, by means of nuts, secure the plate on the inside of the door. This must be done before the waxing of the letters is proceeded with. The bolts now being attached. take some turpentine and

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clean rag, and thoroughly clean all the letters carefully.

The process of waxing requires to be conducted very carefully. The wax made specially for the purpose may be bought at an oilman's; take a sufficient quantity of wax of the desired colour, black or red, and pulverise it in a mortar. Have the plate quite clean, and fill all the cuts with sufficient of the powdered wax, being careful not to let the wax extend all over the plate; then take a camel-hair brush, and gather the wax in a little hillock above the surface of each cut to allow for sinking. Now put the plate into a hot oven and watch it carefully, turning the plate frequently so as to heat it evenly all over. Do not let the wax bubble or boil. As soon as the wax begins to melt take out the plate from the oven, and press the wax in the cuts with a piece of flat iron or steel. It is hardly possible to avoid getting the wax all over the plate, but while the plate is hot it can be wiped off, if it is not too close to the letters.

The plate must now be left to cool gradually. To remove the superfluous wax from the surface of the plate, the water of Ayr stone must be freely used with plenty of water. Rub the stone always in the same direction, lengthways being preferable. The wax being removed, dress the plate with a piece of leather, using crocus, and plenty of common oil to moisten the crocus. A final polish with a piece of soft leather—chamois will do—with lampblack as a polishing medium, will finish the plate and blacken the letters. The mahogany blocks for mounting the plates are made to order by a cabinet maker. But the engraver of small plates is supposed to be able to fix them himself, so that he should be prepared with the necessary tools. Zinc plates, it is scarcely necessary to say, are treated in a similar manner.

Before I conclude the subject of brass and zinc plate work, I must mention two matters which, although not of the greatest importance by themselves, yet, as a whole, will make or mar a brass or zinc name-plate. I allude to the filling of the letters. If a little extra expense be no object, use the very best black or red sealing wax; the appearance will fully repay the engraver for the extra expense involved. My London readers may obtain this best wax at most good stationers', and the cost is usually threepence per stick. The second quality sealing wax is used for very large plates, and is similar to that used by the post-office officials.

The other little matter I wish to impress on the memory of the young workman applies more particularly to cutting zinc. The peculiar nature of zinc tends to "clog" the point of the graver. To obviate this, and to clear the point for the following cut, I usually have at my right hand a small flat piece of wood, pine or deal—in fact, any soft piece of wood will do—which is screwed down to the bench in a convenient position, so that the engraver may dig in the tool after each cut, and so clear the graver point from the zinc which is attracted by the action of the steel while cutting through the zinc.

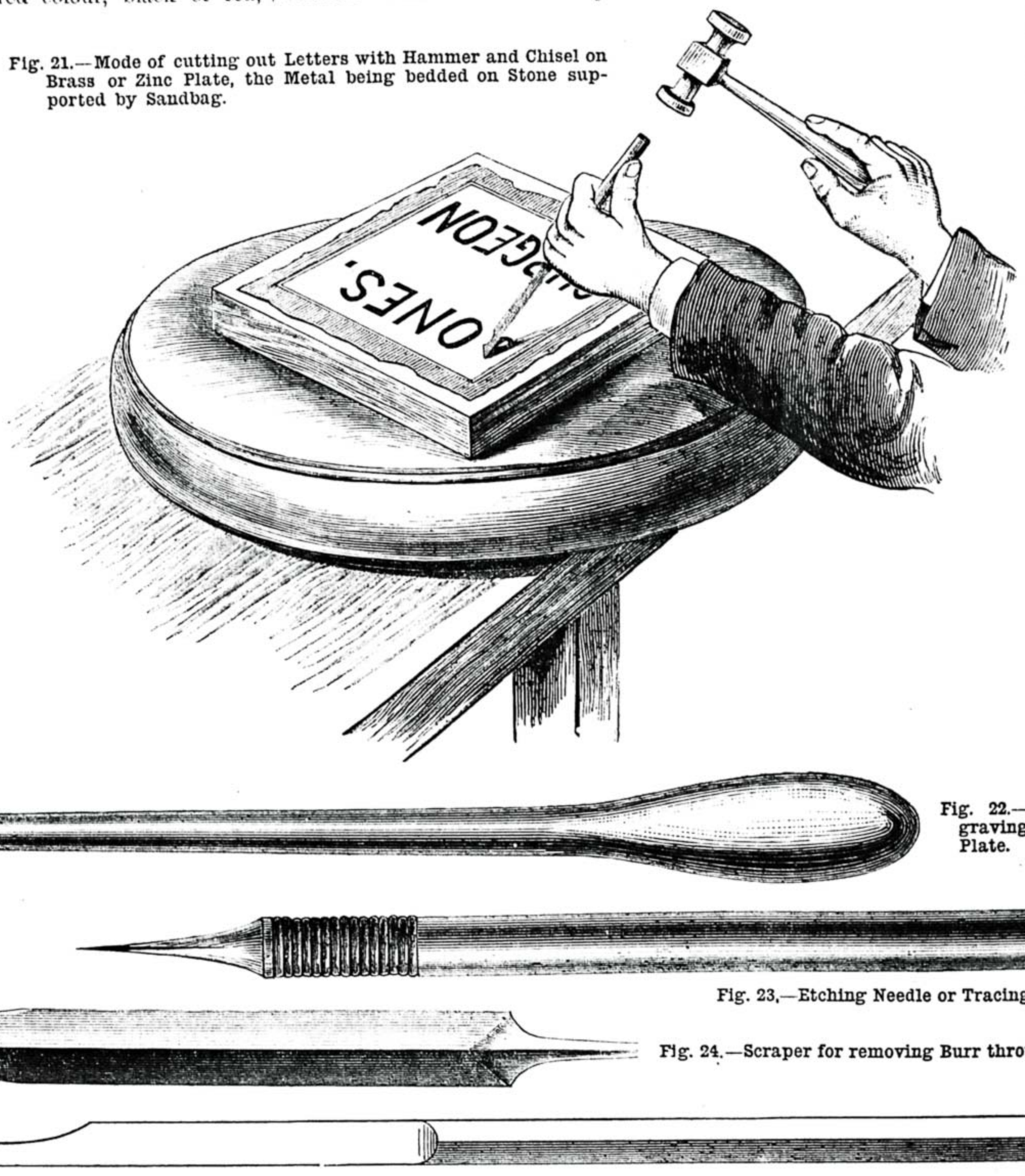

Fig. 21.—Mode of cutting out Letters with Hammer and Chisel on Brass or Zinc Plate, the Metal being bedded on Stone supported by Sandbag.

Fig. 22.—Hammer for Engraving on Brass and Zinc Plate.

Fig. 23.—Etching Needle or Tracing Point.

Fig. 24.—Scraper for removing Burr thrown up by Chisel.

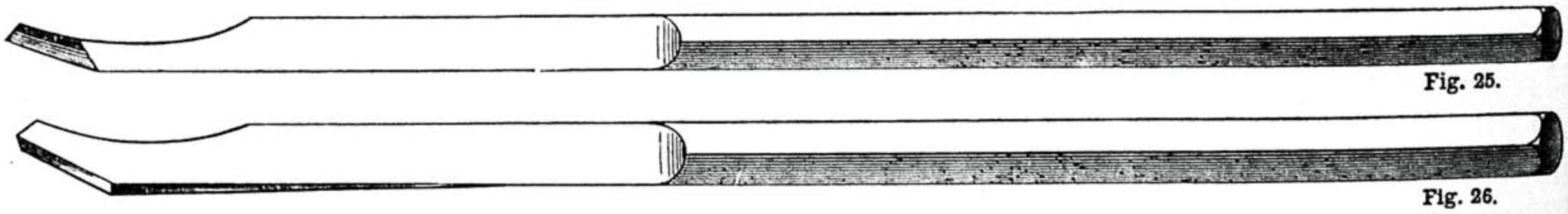

Fig. 25.

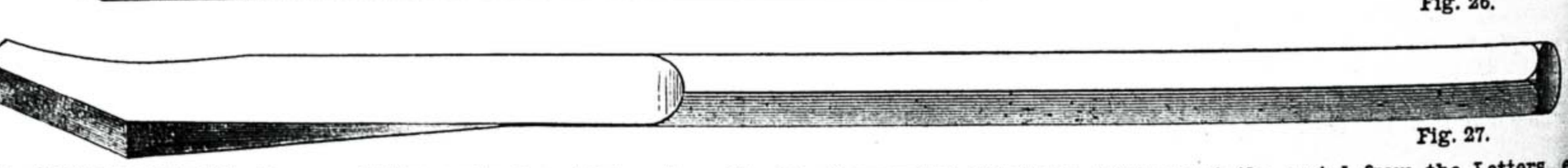

Fig. 26.

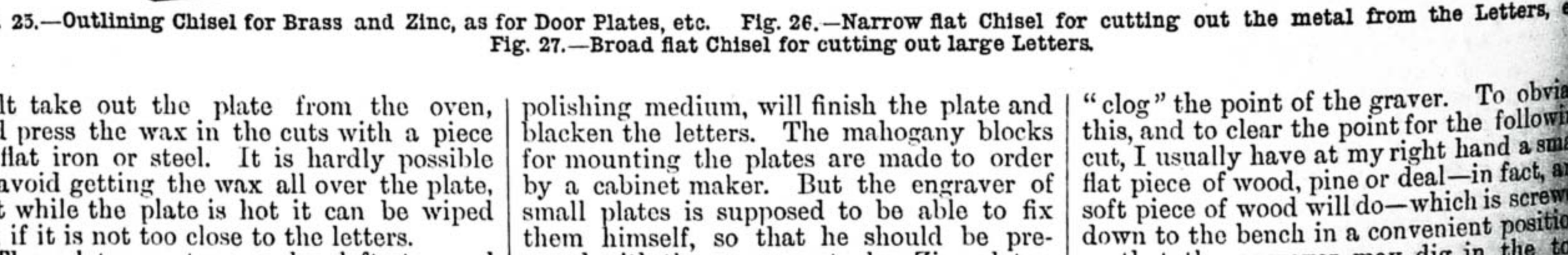

Fig. 27.

Fig. 25.—Outlining Chisel for Brass and Zinc, as for Door Plates, etc. Fig. 26.—Narrow flat Chisel for cutting out the metal from the Letters, etc. Fig. 27.—Broad flat Chisel for cutting out large Letters.

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THE DULCIMER, AND HOW TO BUILD ONE.

BY R. F.

Completion of the Shell and Fitting of Soundboard.

Now take the blocks and gauge a mark 2 in. from the square edge on the under side, and screw the back on level with these marks with No. 6 screws 1¼ in. long. Put in screws at intervals of about 2 in., commencing at 2 in. from the bottom. Grease them before turning them in, as they must come out again before finally fixing on the back. Lay a straightedge across top and bottom, mark off projecting corners of the blocks, and saw and plane them off level, as shown in Fig. 3 by dotted lines.

Now take the back off again, and clean off all burrs or chips that may have got raised, and with some hot and strong—*not thick*—glue, quickly run over two inches of the edge of the back and the underside of the block, and, slipping them together, work them up and down a few times to get a good connection, and drive the screws home. Clean off all glue that has squeezed out, and repeat the operation on the other block. Now fit three blocks of the inch-square stuff 3½ in. long accurately into the angles formed by the back and blocks on each side, glue them in, the first one at a distance of two inches from the bottom edge, A (Fig. 4), and set aside for a day or two to dry.

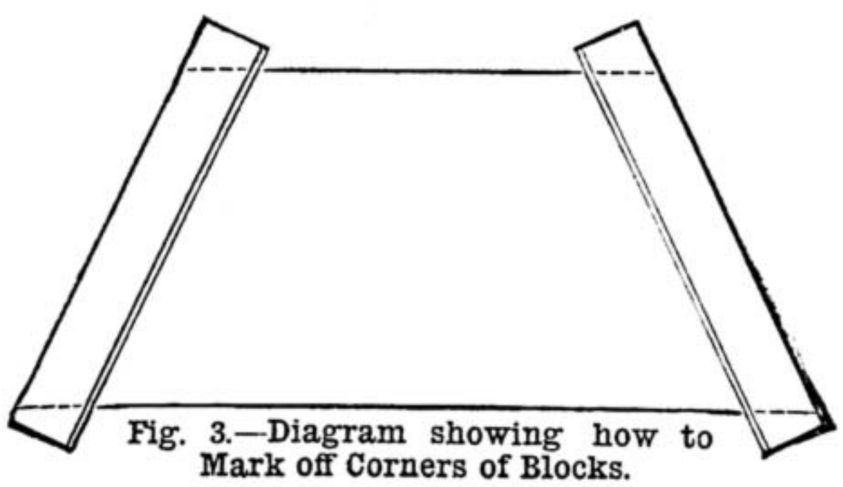

Fig. 3.—Diagram showing how to Mark off Corners of Blocks.

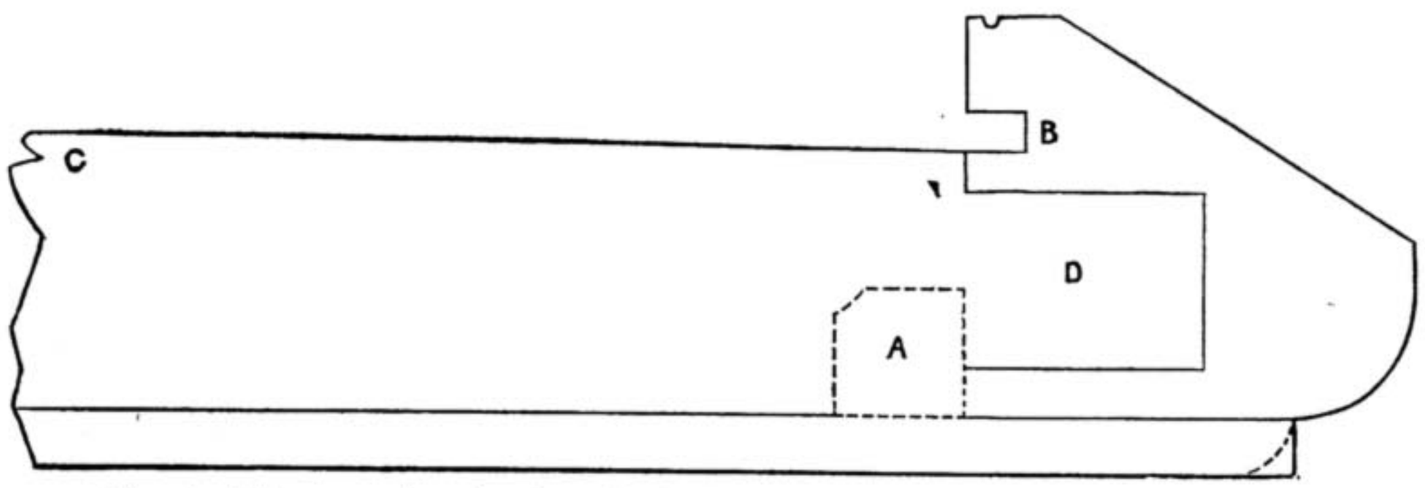

Fig. 4.—Diagram showing how to fit Blocks into Angles of Back and Blocks.

Our instrument is now beginning to take shape, but has yet to be strengthened by "bracing." First, for the front brace. For this cut a mortise in the front end of each block 1½ in. long, 1 in. wide, and ¾ in. deep, D (Fig. 4). Take a piece of ¾ stuff, 2 in. wide, and of the necessary length, and cut it to fit accurately into each mortise, and, at the same time, fit perfectly level on the back. The top edges of this brace at each end must come exactly level with the lower edge of the groove, B (Fig. 4). It must not, however, be quite straight from end to end, but must rise ½ in. in the centre, so that the top of the brace presents a slightly arched appearance. This will give the belly a rather convex surface, as it is found that this form gives a better tone, and also presents a greater resistance to the downward pressure of the strings.

When the brace is finished, fit it into its place, and bore a hole in each tenon to take a 2-in. cut clasp, and along the underside of the front edge of the back bore half a dozen holes to take 1½-in. nails. Take the brace out again, and, quickly gluing the tenons and bottom edge of the brace, also the mortises, whip the brace into its place, drive the nails home, and punch the heads in. The back brace is made and fitted in exactly the same way, except that no curve or rise is given to the top edge.

At the risk of being thought too particular or fussy, here let me caution you to clean off all superfluous glue as you go along, or some may be left that will afterwards cause a deal of trouble by giving rise to an unpleasant jarring through cracking or warping off.

Back and front braces having been fixed, the next things to see about are the inside bridges. Without these the belly would not stand the pressure of the strings, but would "swamp," and most likely split. For the treble bridge, take a piece of the ¾ stuff 1½ in. wide, and fit it between the front and back braces at a distance of 10½ in. from the left bottom corner and 4 from the left top corner. It should be let into the inner sides of the braces about ⅛ of an inch, and must be perfectly flush with the top edges of them. The bass bridge is fitted in exactly the same manner at a distance of 3 in. from, and parallel to, the right-hand block. These bridges must be considerably lightened by boring a series of holes through them with a ¾ centrebit. Draw a line down the centre of each side of the bridges, and mark off at intervals of 1½ in.; then bore through till the bit pricks, reverse the bridge, and complete the operation, as in Fig. 5. Glue the bridges in and fix with two or three screws from the back.

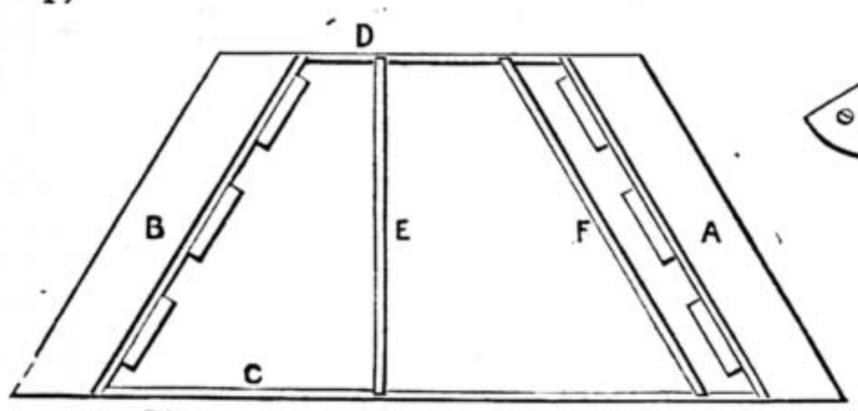

Fig. 6.—Shell of Dulcimer complete.

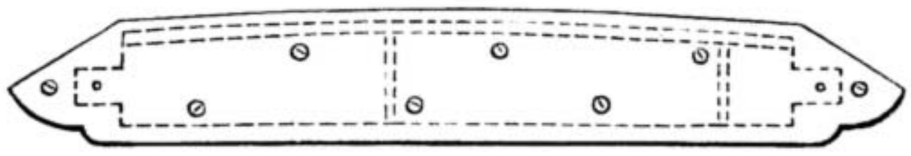

Fig. 7.—Front of Dulcimer with Facing on.

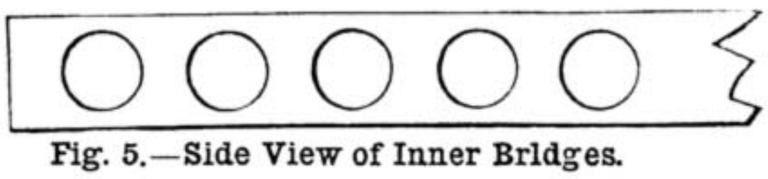

Fig. 5.—Side View of Inner Bridges.

The "shell" should now present the appearance shown in Fig. 6, in which A represents wrest-pin block; B, hitch-pin block; C, front brace; D, back brace; E, treble bridge; F, bass bridge; G, lining blocks.

Everything is now ready for the fitting of the most important part, the belly or sound board. First take your piece of pine, and carefully clean it up till the edges will just fit into the grooves in the blocks, B (Fig. 2). Now carefully draw a line on your blocks ⅜ in. from the inner edge. This will exactly correspond with the depth of the grooves, and, laying your board over the shell, mark off the width from back to front, and reduce the board to within ½ in. of this width; lay it on again, and mark off carefully to correspond with the marks on the blocks, and saw off to these marks. Fit the belly in the grooves by sliding it up from the front. You will find that the arched top of the front brace will make this rather difficult, but a little patience, gentle tapping, and easing where necessary, will soon ensure a good fit. It is not required to fit too tight, but only tight enough to prevent rattling; and, having effected this, remove the board again, and at a distance of 7 in. from the bottom edge and 4½ in. from the left side make a dot for the centre of the treble sound hole, and 6½ in. to the right of this make another for the bass. These sound holes are to be of 2½ in. diameter, and may be cut with a pair of cutting compasses, a cutting-out bit, or a very fine-toothed pad saw. If a saw is used, great care must be taken to avoid splintering the edges. The belly must now be thoroughly sandpapered on both sides, and will then be ready for fixing. Glue the top edges of the front and back braces, and along the grooves and also the edges of the belly, and as quickly as possible slip it into its place and fasten it down with ¾ brads to the braces. Clean off the front and back edges level with the braces, and clean off also any inequalities of surface that may show. The front and back facings may now be put on. These consist simply of pieces of ¾-inch stuff fitted accurately over the front and back edges of the instrument, and when screwed and glued on forming an additional support. The top edges should be raised above the level of the belly ⅛ in. and the ends must be cleaned off level with the blocks.

Fig. 7 shows front of instrument with facing on, under which dotted lines show outlines of belly, brace, and inside bridges. The description of the construction given above will be easily understood with the aid of the figures. I will show how to complete the dulcimer in another paper.

BRASSING: ITS PRINCIPLES AND PRACTICE.

BY GEORGE EDWINSON BONNEY.

Brassing.—The art of electro-depositing brass upon iron, steel, copper, and zinc, is not only a most interesting subject to the student of electro-metallurgy, but is also of great commercial importance, since the value of articles made with any of those metals is considerably enhanced when coated with brass. This art has only been put to practical use in this country during the last twenty years, although it has been successfully practised in Germany and France for a much longer period. Much of the tinselled imitation gold wires, spangles, and threads used in England are only made of copper

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wires electro-brassed, and these are imported in large quantities from France and Germany. Brass was deposited by M. de Ruolz, in 1841, from solutions of the double cyanides of zinc and copper. In 1847 M. Charles de Salzede patented a process for brassing and bronzing steel, iron, zinc, lead, and tin. Although Messrs. Russell and Woolrich patented a process for brassing in 1849, Mr. Joseph Steel another in 1850, and Messrs. Morris and Johnson a good brassing solution in 1852, Mr. Napier writes of it in 1875 as being "a process very difficult, although we understand it is done very extensively by means not made public." All who have had to do electro-brassing agree in saying that the process is difficult. The difficulties usually experienced are a tendency on the part of the solution to deposit its copper or its zinc in excess when a very slight change is made in the depositing arrangements, and a tendency to become poor in metal after being worked for a short time.

The cause of these difficulties appears to be in—(1) The unequal resistance to the decomposing effect of the current offered by the copper and zinc salts held in solution. The copper salts are more easily decomposed than the zinc salts; hence, when a current of low E. M. F. is employed, the copper is deposited in excess. Zinc salts require a higher E. M. F. to effect their decomposition than those of copper. (2). The unequal solubility of copper and zinc as anodes in the depositing solution. It matters little whether the anodes are composed of brass or of plates of pure copper and pure zinc: the effect is the same in maintaining the solution at its proper metal strength. The oxide of copper formed at the anode is more readily dissolved in the menstruum of the solution than is the oxide of zinc, hence the solution soon becomes rich in copper, and correspondingly poor in zinc salts.

The remedy for the first difficulty is to employ a battery or other generator of electricity giving a current of sufficiently high E. M. F. to decompose both copper and zinc salts as required. Now, copper can be deposited from its solutions by a current having an E. M. F. of from half to one volt, but zinc salts require current at a pressure of at least one and three-quarters volts to decompose them. These pressures may be represented in the first case by the Smee and Daniell cells, whilst we must have recourse to the Bunsen cell to provide the latter. Hence the Bunsen has been proved to be the best for electro-brassing purposes, because its current has a sufficiently high E. M. F. to decompose both copper and zinc salts in a brassing solution. The relative proportions of the two metals deposited are also regulated by the volume of current or quantity of current passed through the solution in a given time. It has been proved in practice that when a brassing solution is depositing the alloy in proper condition, an alteration in the anode surface exposed to the action of the current will affect the character of the deposit—an augmented surface causing an excess of zinc, whilst a diminished surface causes an excess of copper. Copper is also deposited in excess when motion is given to the articles receiving the deposit, and this is increased with increase of speed. Zinc is deposited from its solutions at the rate of 18·5 grains of metal for each ampère of current passing through the solution in an hour. Copper is deposited at the rate of 18·1 grains per ampère per hour. Therefore an increase in the volume of current would tend to deposit zinc in excess of copper, and this would be brought about by lowering the anode in the solution, and so reducing the resistance of the circuit.

The second difficulty may be met by employing a solvent in the solution which will readily dissolve the oxide of zinc as it is formed on the anode, and form a double salt of zinc easily decomposed by the current at the cathode. In practice it has been found that liquid ammonia best fulfils the required conditions, since it readily dissolves the oxide of zinc, and then yields its metal up to the free cyanide of potasssium present in the solution, forming therewith the double cyanide of zinc and potassium. When, therefore, the workman perceives his anodes coated with a whitish deposit, or when a whitish powder is seen to fall from the anode to the bottom of the vat, he may be sure that the powder is oxide of zinc, and to dissolve this he must add liquid ammonia to the solution until the anodes again work clear.

When, by practice, the right conditions have been found to deposit the desired colour of brass, such as the E. M. F. needed to overcome resistances and force the proper quantity of current through the solution, the most suitable area of anode surface to the work in hand, and the best strength of the solution, these conditions should be carefully maintained, even to the employment of the same gauge of wire for the slinging wires.

Mr. John T. Sprague, in his book on "Electricity: its Theories, Sources, and Application," gives the following "Principles" as a guide to the deposition of brass and other alloys:—

"1. The object to be attained is the deposit of definite proportionate weights of two or more metals; but as the current knows nothing about weights, but measures its work by equivalents, the proportions by weight desired must be reduced to equivalent proportions, by dividing the weight by the electrical equivalent (of the metal). Thus a brass is required containing 64 copper to 36 zinc; 64 ÷ 31·75 = 2·02 and 36 ÷ 32·6 = 1·08 gives the proportion in which the current must divide itself between the salts of copper and zinc.

"2. The solution need not contain the two metals in either of the two proportions, weights, or equivalent; the relative degree can have no fixed law, as it must depend on several conditions, and mainly upon a combined consideration of the facility with which the two salts decompose, and the equivalent proportion required to be decomposed.

"3. Incompatible salts cannot be joined in one solution (that is to say, salts which exchange their constituents or throw down a portion as insoluble), unless another ingredient is to be added which will re-dissolve the precipitate; this latter is often the case when ammonia or cyanide of potassium is to be added, more especially ammonia. In such cases, however, it must be ascertained that these new conditions do not alter the relative conductivity or decomposability of the various metals in solution.

"4. It is of the utmost importance that the metals of which the alloy consists should not have any strong electric relations to each other in the solution to be used. It must be remembered that what is called the electric order of metals is a pure delusion, unless taken in a particular solution, for a metal may be positive to another metal in one solution, and negative to it in another, as this depends upon the affinities of the metals to the other radicals.

"5. It is *desirable* that the several salts should have nearly the same electric resistance, or that these resistances (which partly depend upon the quantity of each salt dissolved) should be proportioned to the relative currents required; but this is not essential.

"6. It is *essential* that the battery power be balanced against the decomposability of the several salts. This is distinct from their resistance. Each chemical combination needs a fixed force to decompose it, and this is effected by maintaining a sufficient electric tension at the plates to effect it. This may be called the *specific molecular resistance*, set up at the cathode only, while the electric resistance lies in the space between the plates. If there is a great difference between the specific molecular resistance of the different salts, the current will tend to reduce the lowest only, and that, perhaps, in a powdery state; in such cases, the only remedy is to have only a sufficiency of the weaker salt present to supply the required deposit, thus forcing the current to act sufficiently upon the more resisting salt."

Mr. Sprague presents in tabular form a list of eight brassing solutions, from which it will be seen that they all contain cyanide of potassium, with one exception. The decomposable salts in solution are, therefore, simply the double cyanides of copper, zinc, and potassium. In the following table the quantities are proportional to each other, and therefore may be taken as grains, ounces, or pounds.

TABLE OF BRASSING SOLUTIONS.

	1	2	3	4	5	6	7	8
Water .. .	5,000	5,000	1,280	50	400	160	10	2,000
Copper—								
Chloride..	25	15	—	—	2	—	—	10
Acetate ..	—	—	5	10	—	—	—	—
Cyanide ..	—	—	—	—	—	2	—	—
Zinc—								
Sulphate	48	35	10	—	4	—	—	20
Acetate ..	—	—	—	1	—	—	—	—
Cyanide ..	—	—	—	—	—	1	—	—
Potassium—								
Cyanide ..	12	50	8	q. s.	—	16	1	24
Carbonate	610	500	72	—	50	—	—	160
Acetate ..	—	—	—	10	—	—	—	—
Ammonia—								
Liquid ..	—	—	—	40	—	—	—	q. s.
Carbonate	—	—	—	—	—	16	1	—
Nitrate ..	305	—	—	—	25	—	—	—

The solutions mentioned in the foregoing table are made up in the following manner:—

1. This is M. de Salzede's solution: Dissolve the cyanide of potassium in 120 parts of the water. Heat the remainder of the water to a temperature of 150° Fah., and add to it, whilst stirring well, the salts of potash, zinc, copper, and ammonia, each separately until all has been dissolved. Mix the cyanide solution with this, and allow the solution to stand exposed to the air for a few days, then work with a battery of two Bunsen cells giving a full current, and use an anode of brass.

2. This is also a solution introduced by M. de Salzede, and is made up and worked in a similar manner to No. 1.

3. Divide the water into two parts. Take one of these parts and divide into four parts, using each to dissolve the several salts in the following manner. First dissolve the copper salt, and add to it half of the ammonia. Secondly, dissolve the zinc salt in the water when heated to about 180° Fah., and add to it the rest of the ammonia. Thirdly, dissolve the potash in its part of water. Fourthly, heat the remaining part

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of water to about 200° Fah., and dissolve therein the cyanide of potassium. Then mix solutions 1 and 2; add solution 3, then 4, stirring all the time; and finally add the remainder of the water. Work with a full battery power, using a brass anode, and add cyanide or ammonia when required.

4. This is the solution of Messrs. Russell and Woolrich. Dissolve the copper and zinc salts and the potassium acetate in part of the water; then add potassium cyanide until all the precipitate is dissolved. The potassium cyanide should be in excess, to form free cyanide. Work with a brass anode and a full battery.

5. Dissolve the salts separately, then mix together.

6. This is Messrs. Morris and Johnson's solution. Dissolve the salts separately and mix together, adding the cyanide of potassium last.

7. Dissolve the salts in the water and heat the solution to a temperature of 150° Fah. Suspend a large plate of brass in the solution, and connect to the positive pole of a strong Bunsen battery (three or four quart cells in series); suspend a small rod of copper in the solution and connect to the negative pole of the battery, and pass a current until the solution deposits brass freely on the copper rod. The temperature must be maintained throughout, and the solution worked hot. Add cyanide or ammonia carbonate as required.

8. This is Brunell's solution. Dissolve the salts separately. Add part of the potash solution to the copper and the zinc solutions until a precipitate has been formed, then add enough ammonia liquid to dissolve the precipitate; finally add the cyanide solution. Work with a large brass anode and two or more Bunsen cells, adding ammonia or cyanide as required.

Preference is given by Mr. A. Watt to solutions No. 3, 7, and 8, because these contain ammonia, and this dissolves the zinc oxide from off the anode. Whenever a white deposit is seen on the anode, add a little free ammonia liquid. Cyanide is added when the deposit appears to be deficient in copper, and zinc is in excess. When the solution appears to be deficient in metal strength—that is, holds less than a proper working quantity of both metals—it must be strengthened by adding to it a strong solution of the double cyanides of potassium, zinc, and copper. This deficiency is indicated when the alloy is deposited slowly, and has either an earthy or a greenish hue. When the deposited brass has a dull, dead, or matt appearance, the deposit may be improved by adding to the solution a small quantity of arsenious acid dissolved in a solution of cyanide of potassium. The effect of this addition to a brassing solution is similar to that of bisulphide of carbon on a silvering solution, as it gives to the deposit a bright and lustrous appearance. It should only be added in small quantities at a time when required. The arsenious solution is prepared in the following manner:—Dissolve 1¼ ounces of potassium cyanide in half a pint of distilled water made hot on a sand bath, then add, whilst the solution is still hot, 4 drams of white arsenic (arsenious acid), and stir until all the arsenic has dissolved. When cool, place the solution in a glass-stoppered bottle, and label it *Arsenious Solution*, VERY POISONOUS. This poison is even more virulent than cyanide of potassium alone.

Mr. A. Watt (who has had considerable experience in electro-brassing work) prefers a brassing solution made direct from brass. To do this he first dissolves good sheet brass in a mixture of 4 parts nitric acid to 2 parts water, by the aid of heat, until the acid solution ceases to dissolve any more brass. This solution is then diluted with four times its bulk of water, and to this add strong liquid ammonia until the green precipitate first formed is all dissolved, and the liquid assumes a beautiful clear blue tint. To this add a strong solution of cyanide of potassium until the blue colour disappears, and is followed first by a pinkish and then a yellow tint. After this add a little more to form free cyanide, and set the solution aside for twenty-four hours before using. It should contain one ounce of brass to the gallon, and is worked as directed in the preceding paragraph of this article.

Preparation of Metals to be Electro-Brassed.—The various metals intended to receive a coating of brass must each receive special treatment, since all do not receive the brass coating with equal facility. *Cast iron* should be pickled for half an hour in a mixture of sulphuric acid and water, in the proportion of 1 pint of acid to 1 gallon of water. It must then be rinsed in clean water and scoured well with a hard brush, coarse sand, and water, until quite free from black oxide and dirt. When quite clean it should be rinsed in clear water, then in a cold potash dip, again rinsed, and transferred at once to a very rich brassing solution, worked with current of extra high E. M. F. and volume. *Wrought iron* is prepared in a similar manner, but may be brassed in a weaker solution, and with a current of less strength. *Zinc* should be cleaned in a pickle only one-eighth the strength of the above, with two ounces of hydrochloric acid added to the gallon of pickle. It is then scoured in the same manner as cast iron, and immersed in a brassing bath suitable for brassing wrought iron. *Pewter* should be pickled for half an hour in a solution of nitric acid and water, in the proportion of half a pint of commercial acid to one gallon of water. It should then be scoured with a soft brush in fine sand and water, rinsed, and placed in a bath suitable to zinc or wrought iron. *Lead* should be treated in a manner similar to that for pewter, but must be brassed under conditions suitable to cast iron. Only one kind of metal should be placed at one time in the brassing bath, and the slinging wires should be of stout copper wire, so as to offer as little resistance as possible.

Finishing Electro-Brassed Work.—When the articles have received a sufficient coating of brass, they should be removed from the vat and rinsed at once in hot water. This will facilitate the drying, which should be further accelerated by placing the goods in hot boxwood or mahogany sawdust. They should then be brushed with a soft long-haired brush to remove the sawdust, and rubbed with a bunch of clean soft rag or a piece of chamois leather. The goods may now be lacquered or bronzed, or otherwise ornamented, as taste may dictate.

When electro-brassed goods are intended to be lacquered on a golden yellow coating, Mr. Watt recommends that they be finished in a special brassing bath, made up similar to No. 3 in the foregoing table, using copper sulphate instead of the acetate. A few minutes' immersion in this bath will suffice to give a finished yellow coating.

He also says that an indifferent coating on iron or steel articles may be improved by dipping them for a moment in one of the dipping acids for brass, and plunging them at once in cold water. When such metals have received an extra strong coating, they may be thus treated with advantage, the resulting colour of the deposit being equal to that of solid brass.

Much interesting matter respecting the electro-deposition of brass, together with full details of several brassing solutions, taken from French and American sources, and others not mentioned in this article, may be found in Mr. A. Watt's book on "Electro-deposition," pp. 366-394.

THE BUREAU IN GOTHIC STYLE.

BY D. ADAMSON.

HAVING given in previous papers the groundwork or construction of a plain bureau, let us now see how it may be enriched by ornamentation—how, in other words, it may be finished in any characteristic style that may be desired.

It is, of course, out of the question that every style or variety of style can be considered here, for to do so fully in even one of them would require far more space than can be devoted to the subject in its entirety. At the same time suggestions which will, no doubt, prove of service to the novice in directing him how to finish his bureau in a few of the more popular styles may be attempted. The salient features of these will be given, omitting little points which, however interesting to the antiquarian or student of old wood work, would only tend to embarrass the beginner, and perhaps unduly discourage him. For example, much might be said on the minute details by which the Early Tudor is distinguishable from the later Tudor or Elizabethan, and this again from the Jacobean. All are similar, and yet each has peculiarities of its own, not strongly marked in all cases, for it must not be forgotten that in the progress of any art there is no such thing as an abrupt transition from one characteristic style to another. No; the changes are gradual, so gradual that one scarcely observes them passing, and only recognises that there has been a modification by comparing the productions of different eras. Then indeed, the distinctions are apparent, but who can say when first the slight differences which by degrees eventuated in a distinct style were introduced? Even during the last twenty years, while fashions in wood work have been changing with unexampled rapidity, it has been impossible to note the subtle alterations by which one style has superseded another, though the most casual observer cannot have failed to notice that the furniture of to-day is very different from that of only ten years ago. Then the so-called Early English furniture was all the rage, now our leading designers are giving themselves more scope, and the stiff, severe "Early English" has been replaced by what it is hardly too much to say will result, if it has not already done so, in a style as characteristic of the present age as the Queen Anne—which, by the way, is somewhat vague—or the Elizabethan one of former reigns. It will thus be seen that styles, whether in architecture or in furniture—and the two are very much akin—glide into each other as it were. There is no abrupt transition.

Now, although only a few varieties of ornamentation can be dealt with here, the student must not imagine that a bureau, or other article of furniture, cannot be made or finished in any style desired, and as it is

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possible he may wish to try his hand at designing, the reference made above to architecture will supply the clue. Naturally enough the furniture of any period or country is in harmony with the style of the buildings within which it was placed, so that the designer in adapting old styles to modern articles can find a store of detail by studying the architecture of the corresponding period. This, it will be observed, is a very different matter from copying or reproducing as some might like to do. No doubt if this could be managed difficulties would be diminished to some extent, at least so far as designing is concerned; but when furniture is in question it is altogether impracticable. Why? For the simple reason that furniture, as we understand it, is a modern invention. Even that of comparatively recent times is quite out of character with our ideas of taste and comfort, so that the mere copying of old examples would be useless, even if, indeed, there were any to copy. Take, for instance, the bureau. We may want to make one in Gothic style, but we shall look in vain for an example contemporary with it. That, however, does not prevent us making the bureau with Gothic characteristics, for these can be adapted to it. We seize a few, or it may be only one, of the leading features of Gothic ornament, apply it to the modern contrivance, whether furniture or other articles, and lo, we have this in Gothic style, not a copy of a piece of Gothic work, but a piece of work in Gothic style. Herein consists the principle of making anything in any style. Now, let us see how we are to apply this principle in constructing a "Gothic" bureau, bearing in mind that no great elaboration can be attempted, but that the design must be such that an amateur of ordinary skill could execute it. This restriction, of course, confines us within very narrow limits, but as some compensation for this it must not be forgotten that simple ornamentation properly done is likely to be far more effective than more ambitious work badly executed. A simple rendering of any style can be given, for it is not necessary to crowd in every variety of detail which may be attributed to it, and this remark is, perhaps, peculiarly applicable to the Gothic, which, having been developed principally in work of an ecclesiastical character, is not so well fitted for reproduction in domestic furniture. Certainly Welby Pugin, and one or two other designers, have done their best to popularise it, and have given us sufficient evidence that it is adaptable to work of the highest excellence; but the fact remains that there is something about it which does not commend it as a suitable style for modern furniture. It may be said that the reason of its failure to do so is an evidence of want of taste; but it may almost, with greater show of reason, be urged that its rejection is a proof of instinctive artistic perception of its unfitness. It is essentially a style for stonework, and in adapting it to modern furniture much of its beauty is lost. Perhaps association of ideas may have something to do with the dislike to pure Gothic domestic fittings, but whether or not this is the case the style has never really taken any substantial position in our homes, and when it is seen in furniture it is generally in a very modified form. In Fig. 1 we see how we may give a slight Gothic character to the bureau without in any way departing from the structural details described, except that the cock-beading round the drawers is omitted. It will be noticed that the edges of the rails between the drawers, etc., are what is known as stop chamfered, an effective, and at the same time a simple, means of giving a semi-Gothic feeling to an otherwise plain piece of furniture. As will be seen by Fig. 2, which shows the chamfering on an enlarged scale, the edges are bevelled till within a short distance of the ends. The front edges of the ends are treated in a similar manner, a stop being made near

Fig. 1.—Gothic Form of Bureau.

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the rails, except on the outer edges, where the chamfering runs through almost from the top to the bottom. To chamfer evenly and neatly a special tool should be used, as an ordinary bull-nose plane, though effective in practised hands, is likely to produce unsatisfactory results. The little contrivance represented by Fig. 5 is so simple both in construction and manipulation that the amateur need not waste money on the more elaborate planes specially prepared for chamfering. It compares favourably with any of them, except, perhaps, that it is not quite so quick in action. This is how it is made. Two pieces of wood, say, ½ in. thick, 2 in. or 3 in. wide, and of any convenient length, have a triangular piece cut out—the angle for ordinary, *i.e.*, square-edged, work being 90°. Between these two pieces a chisel is placed, with its cutting edge filling up the angle as shown by the shaded portion of the diagram. The two pieces of wood are then screwed together, and bind the blade tightly. If necessary a little space for this to lie in, and prevent any tendency to lateral play, may be cut. The depth to which the chisel projects below the apex of the triangular space must be regulated by the width of the intended bevel. To use this handy little appliance it is only necessary to draw it backwards and forwards along the edge of the board to be bevelled till it will remove no more stuff, when the bevelling is complete. It will hardly be necessary to say that one of the sides of the triangular space of the stock must be kept continuously against the wood being chamfered, and that if this ordinary precaution is observed the chamfers must be regular.

To elucidate the action more clearly to those who may not have grasped the idea in Fig. 5, the tool is shown against the section of the board, A, the edge of which has been bevelled to the full extent of which the cutter is capable. The dotted lines may be said to represent the portion of the chisel between the two pieces of wood which form the stock. The ends of the chamfer or the stop must be finished off with a chisel, for neither the little arrangement described nor any other chamfering tool will do this.

I do not know whether it will be advisable to remind beginners that this

Fig. 4.—Section of V Groove.

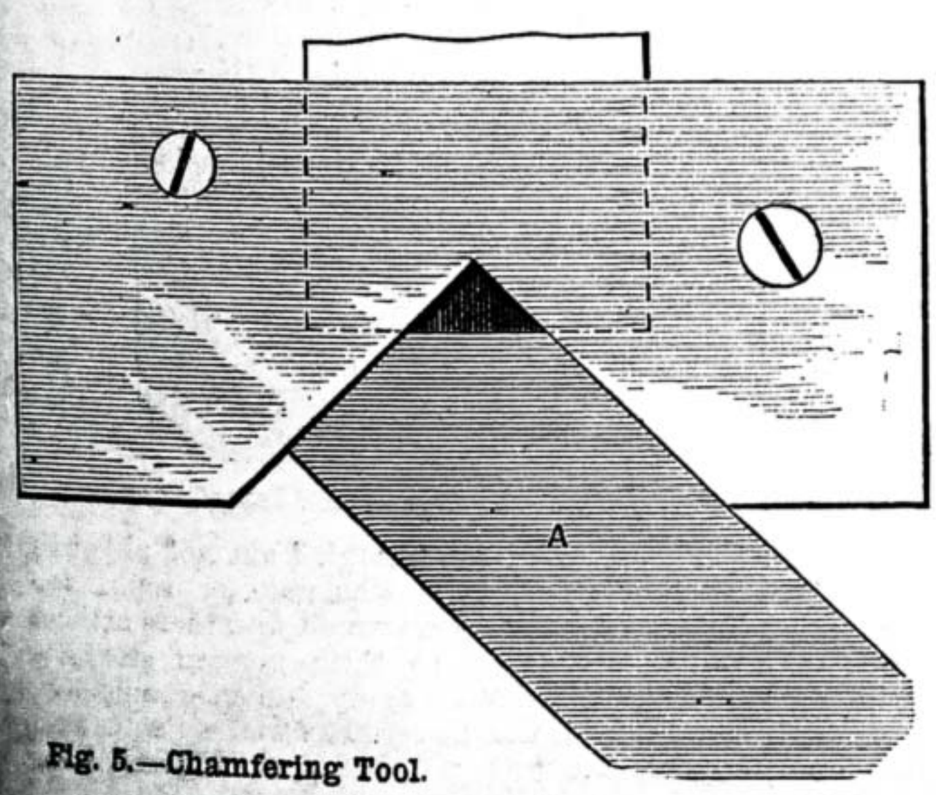

Fig. 5.—Chamfering Tool.

portion of the work, the chamfering, may be more conveniently managed before the parts are fixed together, though it may not be absolutely necessary. In Fig. 1 it will be noticed that the drawer fronts have bevelled edges, but if preferred they may be left plain. In this case they should be set back a little so as to clear the chamfers, for the effect would be anything but pleasing were they to be flush with the faces of the rails and ends. In Fig. 2 the relative correct position of the drawer front is indicated in section by B, the projection of the chamfered rail being unmistakable. In the same

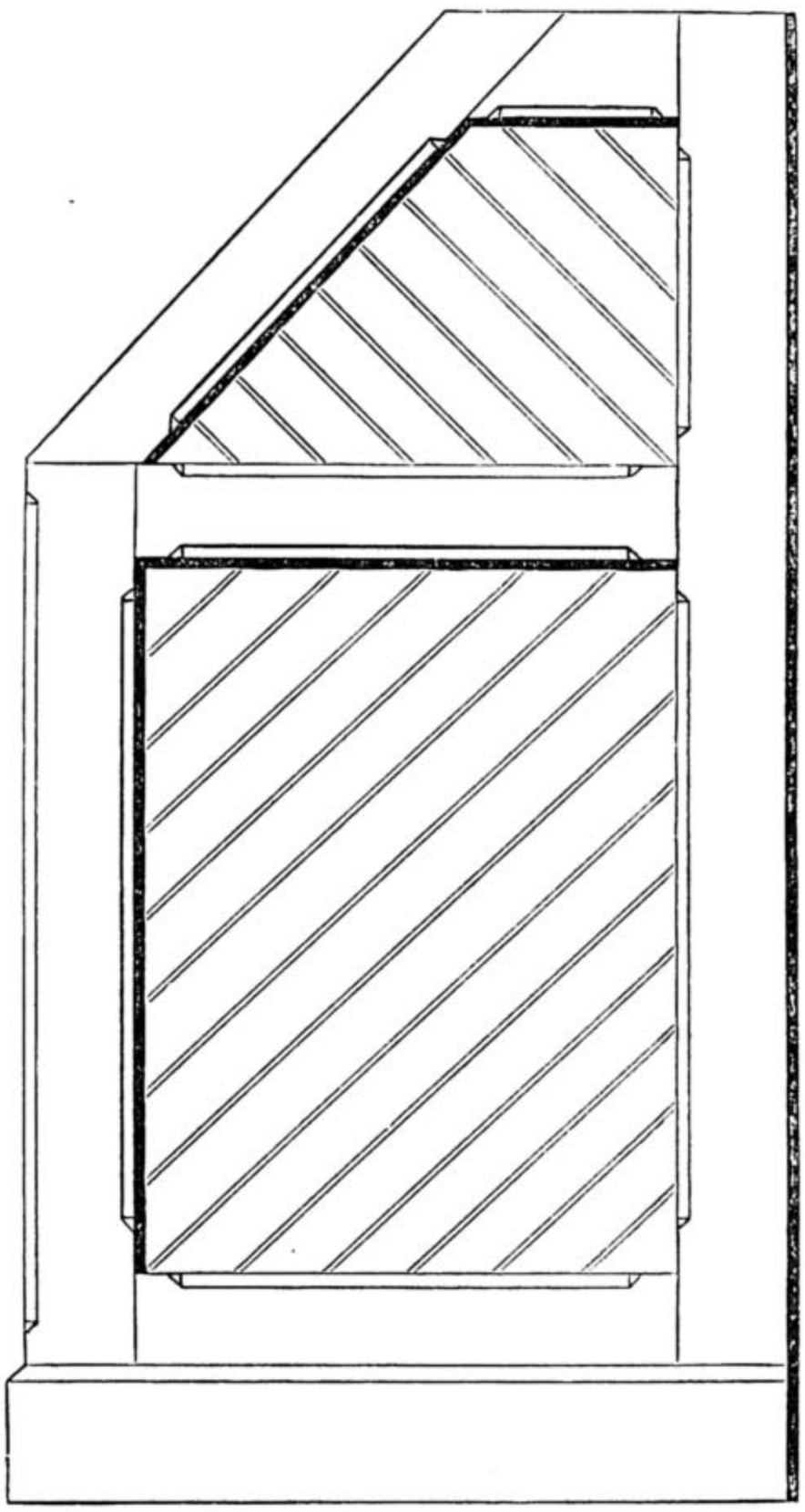

Fig. 3.—Panelled End of Gothic Bureau.

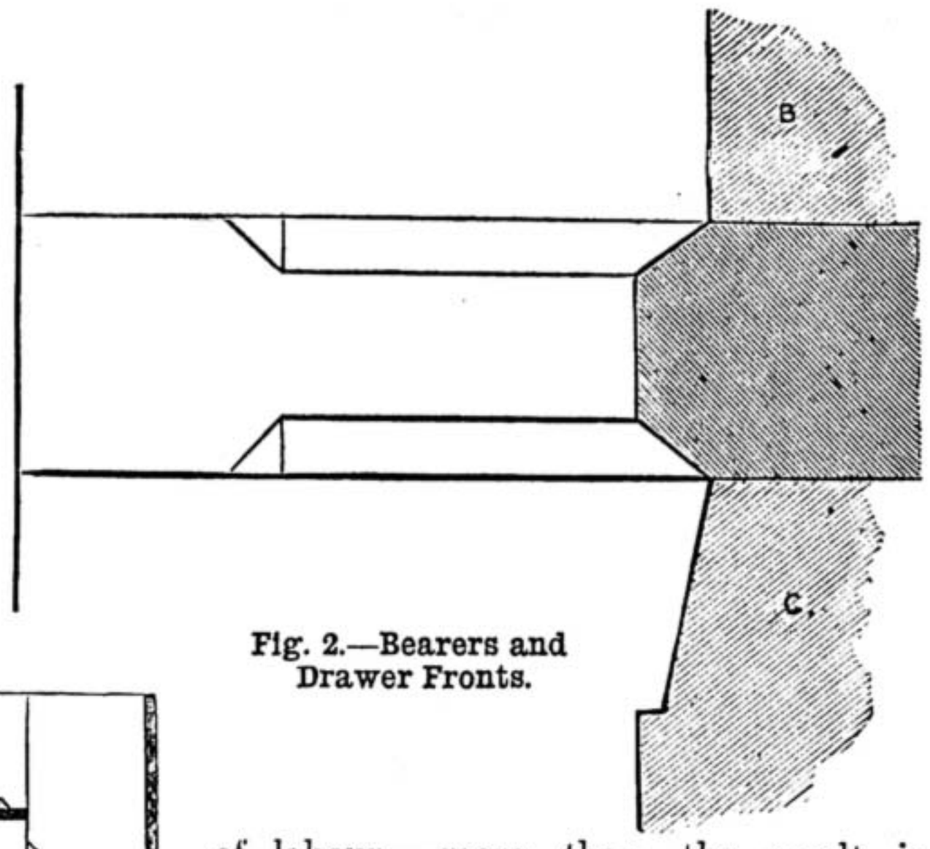

Fig. 2.—Bearers and Drawer Fronts.

illustration C represents the section of the bevelled edge of a drawer front. It will be seen that the bevel is sunk slightly below the face of the front, as the trifling break gives a much better effect than if the bevel started direct from the flat. Besides which, it renders clean, true work more easy of accomplishment, especially if the bevel is a fairly wide one, when it would otherwise be a most difficult matter to get a sharp, clearly-defined line. To form the sunk bevel a rabbet plane will be indispensable, for unless the bevel can be cut regularly it should not be attempted, and it is almost impossible to do so by other means without a considerable amount of labour—more than the result is worth. In forming the bevel first mark it all round the front with a cutting gauge, then take a little off on the outside of the line with a chisel, taking care not to let this cut on to the flat front of the drawer. A guide is thus formed for the rabbet plane to work against as it cuts down the bevel, which on the end grain will probably have to be finished off with glass paper. This should be held round a flat, straight-edged piece of wood instead of on the ordinary cork rubber, in order to avoid rounding the edge of the break between the bevel and the flat surface. It is almost needless to say that the upper edge of the plinth should be simply bevelled off instead of being moulded as in the original bureau, and that the edges of the lid should be finished in a similar manner rather than be rounded off.

If further adornment to the bureau be desired, we see how it may be managed by referring to Fig. 1, where the lid or fall is represented with the panel sunk slightly below the framing, the edges of which are seen to be stop chamfered. Further, the panel itself may be channelled or grooved as shown by the diagonal lines, in which case it will be as well to let the grain of the wood run parallel with them, instead of from end to end of the lid. The section of the channels or V grooves, as they are commonly called, from their resemblance to that letter, is shown by Fig. 4. They may be easily formed by the use of a plane, the sole and iron of which are shaped to correspond, but as a grooving plane of this kind is hardly likely to form part of the amateur's outfit, the alternative of cutting the groove with a chisel will probably have to be resorted to. If, however, the plane is accessible to any who may not know how to work it when they have got it, it may be said that a guide in the form of a straight piece of wood will have to be temporarily fixed to the board to be channelled. There will then be no difficulty in ploughing the grooves straight and even. To cut the grooves with a chisel is certainly a more serious matter, but with care there is no reason why the work should not be as successfully accomplished. If it is considered to facilitate operations the channelling—which, by the way, should not be too wide, say not over ¼ in.—a small gouge may be used at first, the channel afterwards being brought to its proper shape with the chisel, or with a scratch or router, of which a full

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description was recently given in these pages. Those who possess a carver's V tool of rather large size may be reminded that they have a ready means of doing the required shaping; but even with its aid the grooves will very likely present an uneven appearance, unless some skill in handling it has been acquired. Provided the lines are straight, though, there is not much difficulty in reducing them to the regularity without which they will be but unsightly blemishes. The useful glass paper must be resorted to. Fit this over the edge of a piece of wood, which has been bevelled to correspond with the groove, and rub till a sufficiently clean channel has been got. By a moderate exercise of patience and even papering, a result which will compare favourably with the more speedy method may be obtained. Of course in rubbing down the groove with glass paper, the piece of wood on which this is wrapped must be held firmly, for if allowed to play from side to side, first sloping one way and then the other, it cannot be expected that a clean, sharp-edged V groove can be got. A little practice on a waste board is advisable before attempting to channel a valuable piece, for however simple the operation may be, a few experiments will show the necessity for care not only in getting the lines equal, *i.e.*, of the same depth and width, but equidistant from and parallel with each other.

For those who want a still more elaborated bureau a suggestion is given by Fig. 3. There, instead of the end being plain it is seen to be panelled, the edges of the framing being stop chamfered, and the panels themselves being V grooved to match the front of the work. The framing may be about 3 in. wide, and should hardly be of less than 1¼ in. stuff, which those who are familiar with wood working will know will be little, if at all, over 1 in. thick when finished up. If the framing is made from 1½ in. stuff it will be all the better. The panels should not be of less than ½ in. stuff, which will do very well, as they are not large, and instead of being channelled as shown, they may be bevelled to match the drawer fronts. The framing is fitted together by mortise and tenon joints, which those who have a craze for old-fashioned forms of working will probably think should be fastened by wooden pins running through instead of by the more modern, less barbarous, and equally efficient glue. The panels may be let into rebates run on the inner side of the framing, or be let into ploughed grooves. In the former case they should be fastened in with beads, in the latter the grooves hold them. No glue will be required; in fact, it should not be used to fasten in the panels, for the reasons given when the necessity for allowing for the natural contraction and expansion of wood was referred to. Fasten the panels into the grooves or in the rabbets with glue, and they are almost certain to split, but allow them play, and even moderately seasoned wood may be used without fear of splitting. Naturally, if there is an idea that the wood, from being green or unseasoned, will shrink to any great extent, the grooves or rabbets, as the case may be, must be deep enough to prevent the panels drawing right out of them.

Nothing more need be said about the construction of a "Gothic" bureau, but, no doubt, it will occur to those who intend to make one that pitch pine is the kind of wood which seems the most appropriate for this style. Not that there is any valid reason why it should not be made in any other wood, only somehow or other this plain Gothic wood work is generally associated in one's mind with pitch pine—or perhaps I should say in mine, for I don't know how the idea may strike others—much in the same way that Chippendale's work suggests choice old Spanish mahogany—only the association of ideas, nothing more. Well, if pitch pine is to be the material, see that it is dry and well seasoned, thoroughly so, for, unless it is, it is sure to split, and afford, in a marked degree, an evidence of the way wet stuff "goes." If the novice wants to know what this "going" means, he is informed that the vagaries of wet, *i.e.*, green, or, to use a less technical word, unseasoned wood, are so numerous that space forbids a detailed list of them. It may, however, be said that they are all annoying, and that "going" is only a colloquial abbreviation of "going wrong." Pitch pine is peculiarly afflicted with this tendency, though if care is exercised in the selection of sound dry stuff, it may be used with as little hesitation as any other wood. It only remains to be said that the brass handles and keyhole escutcheon plates, if any are used, should be in keeping with the Gothic character of the work, for unless they are they will, instead of improving it, rather be a detraction.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

108.—PATENT UNBREAKABLE STEEL PULP WARE.

THE peculiar ware which I have the pleasure of bringing under the notice of the readers of WORK in this number will, I think, be welcomed by all who desire to practise economy at home. It is known as the Patent Unbreakable Steel Pulp Ware, and as far as the word "unbreakable" goes, it certainly merits the name. It is sold wholesale by Messrs. W. B. Fordham & Sons, Limited, 36 to 40, York Road, King's Cross, London, N., who are the sole selling agents for the United Kingdom. It is designed, in a great measure, to take the place of earthenware, and certainly possesses considerable advantages over this material, for it is much lighter in weight,

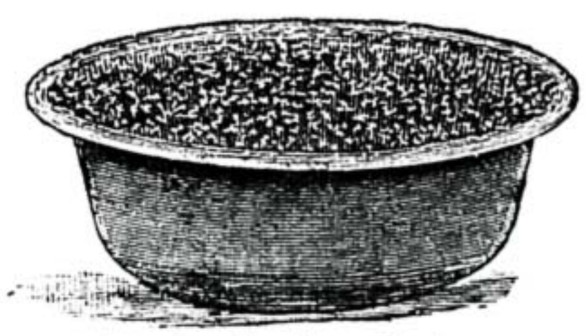

Fig. 1.—Shallow Basin.

and is not brittle or liable to chip. Indeed, it may be dropped from the hand, thrown about, or even dashed to the ground with considerable force without danger of breaking or fear of harm, and it will stand boiling water. At first sight, and on first handling it, it might be supposed to be a peculiar kind of papier-mâché, but this material is neither as strong nor as durable as the steel pulp ware, and will not stand the action of boiling water. Judging from its appearance, the foundation for the material seems to be a fine wire netting pressed into shape on suitable moulds, and then covered with a material which fills all the interstices, the whole being subsequently enamelled or japanned; and I am led to this conclusion by my knowledge of the substance sold as opaque wire roofing, which consists of sheets of wire netting covered on each side by some gelatinous substance. But this is mere conjecture on my part, for I have not yet had an opportunity of breaking up a specimen to see whether or not I am right. The surface has the appearance of earthenware, and the patterns painted on it render it highly ornamental. All kinds of articles in general use in every household are made of it, bowls and basins of all kinds (Fig. 1), oval tubs for washing-up purposes (Fig. 2), crumb brushes and trays (Figs. 3 and 4), bread trays (Fig. 5), flower-vases or cachepots (Fig. 6), waiters (round and oval), sponge dishes and show bowls, which may be supported on brackets sold for the purpose, finger plates, jugs, and all articles comprehended in toilet sets, and plaques, 6, 8, 10, and 12 in. in diameter, suitable for painting, and far easier to paint on than porcelain. Prices range low, and compare favourably with japanned goods and earthenware; thus the crumb brush and tray, shown in Figs. 3 and 4, are supplied at 36s. per dozen, or 3s. for

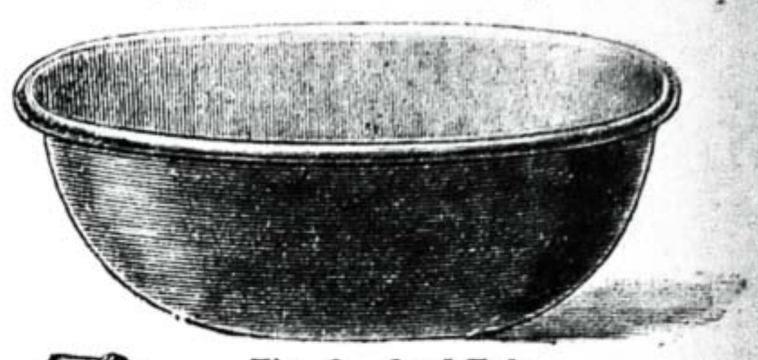

Fig. 2.—Oval Tub.

Fig. 3.—Crumb Brush.

Fig. 4.—Crumb Tray.

Fig. 5.—Round Bread Tray.

Fig. 6.—Flower Vase: latest shape.

the brush and tray, though I am not able to say whether this is the wholesale or retail price. Sellers of fancy goods would find these articles a valuable addition to their general stock, and likely to command a ready sale on account of the durability of the material as well as satisfactory appearance.

THE EDITOR.

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SHOP:

A Corner for Those who Want to Talk It.

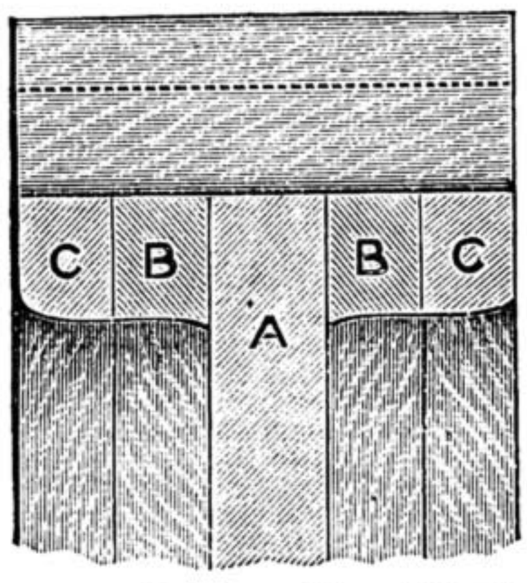
*** Notice to Correspondents.—*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

The Labour Laws.—"J" writes:—"From a recent report presented to the House of Lords on the laws affecting the hours of adult labour in various Continental and other countries, we gather a large amount of information on this deeply interesting question, and we are confirmed in our opinion that the average British workmen are better off all round than those in any Continental country. We subjoin a few notes jotted down in the course of perusal of this paper, thinking they will be read with interest by all those who, like ourselves, are personally interested in problems relating to the hours and conditions of labour. In Austria-Hungary the law limits the duration of work in mines to a shift of 12 hours, 10 only of which must be spent in actual labour. For factory hands the limit is 11 hours, exclusive of hours for rest and meals. Sunday rest is to be observed. These provisions may be subject to modifications in certain specified cases of emergency. In Hungary there is no general law affecting the hours of labour, and in some cases consequently they are excessive. A day's work of 10 to 12 hours is the normal, but in some industries and localities the working day extends from 12 to 15, and even 18 hours. Sunday rest is not prescribed, and the factories working on Sundays and holidays are 25 per cent. of the whole. There is no law in Belgium regulating or limiting the hours of adult labour, and great variations exist in consequence. In the mining districts the average day is 12 hours, but women are often employed 13 or 14 hours in loading trucks and similar heavy work. Cabinet makers at Ghent and Brussels often have to work 17 hours a day. Railway guards are often on duty for 15 or even 19½ hours at a stretch. Brussels tramway drivers work from 15 to 17 hours daily, Bremen from 10 to 17, and often half day Sundays. Brickmakers 16 hours in summer. In sugar refineries from 12 to 13 hours. Eleven hours is considered the average day's labour in the majority of trades in Belgium. There are a number of labour decrees in France, but as they mostly affect particular trades, no brief general statement can be given. But the report states that, as a rule, it may be said that Frenchmen in factories are present at least 14 hours out of every 24 in the shops. And it must be borne in mind that there is no compulsory observance of Sunday, and no day of habitual rest. Neither in Germany, Spain, Sweden, Turkey, nor in Denmark or Russia, are there any laws limiting the hours of labour. In Russia it is stated that they vary from 6 to 20 hours, but in the majority of cases, estimated at 80 per cent., the hours of labour are 12 and under. Manufactories with 12 hours daily labour number 36·8 per cent., those with 11 hours 20·8 per cent., those with 10 hours 18·1 per cent., with 8 hours 1·6 per cent., with 7 hours 0·4 per cent., and with 6 hours 0·2 per cent. Night work is pursued in 247 establishments. But the majority open at 5 a.m. and close not later than 9 p.m. In Saxony there are no laws affecting hours of adult labour, but the normal working day consists of 11 hours, exclusive of meals. In Switzerland the law limits the normal working day to 11 hours, reduced to 10 on Saturdays and holidays. There are numerous laws in the United States affecting the hours of labour, subject to various exceptions. We can only summarise a few of these. In New York mechanics work 8 hours; in most cities of the State nearly all mechanics and all connected with the building trade work 9 hours, except on Saturdays, when 8 hours is the rule. On the street and elevated railroads and in cities of over 500,000 inhabitants 10 hours is the normal day. In New Jersey hours range from 53 to 60 hours per week; in Rhode Island 10 hours daily; in Maryland an average of 10 hours; and the same in Virginia, North Carolina, Tennessee, Arkansas, Louisiana, and Missisippi, where there are, however, no legislative enactments. In California 8 hours is the day limited by statute, which statute, however, is constantly evaded, so that some of the trades which are unorganised work 12 or 14 hours daily. These examples are selected from a large number given in the report, and they take no account of exceptional cases which are recognised by the statutes. They also apply only to adult labour, but there are a large number of statutes regulating women and child labour, which in some countries is very severe. On the whole, the organised trades of this country may congratulate themselves on holding the best position among the European workmen, and second to none in the matters of hours of labour, second only in remuneration to that of the workmen in comparatively new countries like the States and our Australian colonies."

II.—Questions Answered by Editor and Staff.

Patterns of Spur Wheels.—H. L.—In reply to your inquiry "how to make patterns of wheel and pinion, wheel to have 44 teeth, pinion 13, pitch ⅝ in., width 1½ in.," you will cut the pinion pattern from solid mahogany, but not the wheel. The latter should be built up in overlapping segments, and the teeth glued on. The sizes of your gears will be thus:—wheel, 44 teeth × ⅝ in. pitch = 27·5 in. circumference = 8¾ in. pitch diameter; pinion, 13 teeth × ⅝ in. pitch = 8·1 in. circumference = 2⅝ in. pitch diameter; your teeth will measure $\frac{5}{16}$ in. in length below pitch line, and $\frac{3}{8}$ in. in length above pitch line. The diameter of the wheel rim therefore before the teeth are put on will be 8⅛ in. The wheel section is shown in the figure. The plate, A, may be made of a single thickness of wood, properly with one or two open joints, or it may be built in two thicknesses of segments with joints radiating towards the centre and overlapping—that is, made to break joints with one another like bricks in a wall. Upon each side of this plate build two thicknesses of sweeped segments, B and C, also with breaking joints. Then turn the rim to the section given, giving no taper, or at least no more than just sufficient to let the square touch tight and slack on top and bottom faces. The teeth will be either worked to shape first and fastened on afterwards, or glued on as rough blocks and marked out and worked in place. In the first method the teeth may be worked successively in a wooden templet block of the same



P.L.

Section of Spur Wheel.

section, and glued to the rim by their centre lines, the rim being pitched out carefully. In the second the blocks will be glued on rough, turned when dry, flush with the wheel faces, and to the diameter of the tooth points; struck out on both sides and worked through with gouge and chisel, using a rebate plane for those portions of the faces which can be so got at. Their linear accuracy will be tested with a thin straightedge narrow enough to go between the teeth. A little very careful glass-papering will follow by way of finish. The pinion is best worked from a solid bit of stuff, the grain running in the same direction as the teeth. The block when turned will be therefore simply a solid wheel blank of $3\frac{1}{16}$ in. diameter, upon which the tooth shapes will be marked to be then cut through with gouge and chisel. The correct shapes of the teeth are obtained by the application of cycloidal curves. That is the pitch line of the wheel or pinion, as the case may be, is the base upon which a generating circle or circles are rolled for the development of suitable cycloidal curves for tooth flanks and faces. The dimensions of the generating circle may be properly varied with the sizes of the wheels and the nature of the gear desired. But a general rule is that it shall not be of larger diameter than the radius of the smallest wheel of a set. And a fundamental rule is that in mutual gears the same circle which strikes the flank curve for a wheel must be used to strike the face curve for its pinion, and that used for striking the flank curve of the pinion must be used for striking the face curve of the wheel. It is not necessary that both circles be alike, but a different circle may, if desired, be used for the flank and the face of the wheel, or of the pinion. In practice, however, it is usual to make use of a single describing circle throughout. Then any number of wheels in a set so designed will work together correctly. The best application for patterns for good delivery is common shellac varnish, made by dissolving shellac in methylated spirit, and applied with a brush. Vermillion, red lead, or lamp black are often mixed with the clear varnish to impart greater body, and render the surfaces of the pattern harder and more durable.—J.

Gilding.—B. P. (*Haverfordwest*).—Our friend wishes to know "how to finish mat gilding so that it will look bright and stand dusting." The question at once conveys to any experienced worker in gilding how very little the querist understands of the subject. To fully answer B. P.—however much one may desire to help and enlighten the perseverant worker in these columns—would occupy all "Shop" of this issue. Nevertheless, I trust he will appreciate the brief explanation, and that which only space herein will permit, hoping that, in time, room may be found in Work for a complete and exhaustive treatment of both "water" and "oil" gilding. Our correspondent's question refers to the former process, which involves a distinct trade and calling. Mat and burnish are the two treatments applied to picture-frame gilding, the former meaning a "dead" or dull surface of gilding, and the latter, as the word implies, gilding finished with a very high gloss or burnish. To obtain these two results special knowledge and personal experience is necessary—in fact, the tuition common to an apprenticeship—and the various stages through which mat and burnish gilding have to be brought ere arriving at a successful job are of such a nature that letterpress cannot practically teach them. Mat size and burnish size can be purchased from any dealer in gilders' materials; they are then in the form of a thick paste, the former a pink colour, and the burnish a slaty grey colour. Before a frame can be gilded it has to be gone over a great number of times. When the gilder receives it in the plain wood and "compo," he first coats it with "thin white," viz., prepared gilder's clear size with a little gilder's whiting added; then all dents and crevices are stopped with a putty made from whiting and strong size. After this the frame has four or five successive coats of white, but with a greater proportion of whiting than the first coat, care being taken to keep the shape of the frame clear. It will be understood that each coat has to be thoroughly dry ere adding another. The white will then be about the $\frac{1}{16}$ of an inch in thickness, when it is rubbed down to a smooth surface with water and pumice and other hard stone, shaped to suit the form of the members composing the design of the frame. This process requires care and experience especially. When dry it is rubbed with very fine sandpaper, and now it is ready for the coating with size—viz., the mat and burnish which has been already prepared and diluted with parchment size. Four or five consecutive coats of size is necessary to get a good surface, and this, when obtained, is washed with soft linen rag and water to get the parts to be left mat quite smooth. When the desired surface is obtained and thoroughly dry, the mat parts are gilded by wetting a small portion with a large camel-hair pencil and laying the gold leaf upon it. The gilder then blows with sufficient force to cause the water to pass from under the gold leaf, when, by the strength of the coatings of size underneath, the gold is firmly held when dry. Piece by piece the leaf is laid until the mat parts are finished, when, after careful examination and repairing of faulty little places, it is sized and thus finished. Burnish size—the only, so to speak, mysterious part of the business—is a curious compound of curious things, such as, I believe, pipeclay, blacklead, size, suet, red chalk, etc., the preparation of which is still one of those reminders of the "good old times"—namely, a "trade secret." Briefly, its nature is such that, when spread upon rounded surfaces and after the gold leaf has been laid, as in mat gilding, upon it and has become quite dry, it does not become hard and brittle, but allows its component parts to be rubbed and worked up under the gold to a very smooth and brilliant surface. As the brilliancy of any gilding depends solely upon the smoothness of the surface the gold leaf is laid upon, the burnish of water gilding is thus explained. The tool, or burnisher, used is a polished piece of flint or agate, mounted in a suitable handle and formed in various sizes to meet the different shapes of the frames. Ormolu, as gilders term it—in further answer to B. P.—is a richly coloured preparation of spirits of wine used for adding, in small proportion, to the last coat of parchment size which is given to all gilding with gold leaf, and for the purpose of giving the size a rich and golden colour. I trust our correspondent will appreciate this effort to explain a most difficult subject, and one, as before said, which cannot be taught by book.—F. P.

Cabinet in Fret Cutting.—A. D.—If you will re-read the paragraph at the top of column three, first page of Work, I think you will see how it is done. But in case that account is not clear I will repeat it. First line the back of the wood with a piece of printed matter, preferably a picture. Then having mounted your tracing of the design as usual for fretwork, drill the needful holes for the insertion of the saw, with a fine drill, and always in the corner or at an acute angle, close to the saw cut that is to be. Hold the saw rigidly upright in working, save all the pieces cut out, and having stained either all the bits, or the fretwork, as you prefer (not both, of course), replace the pieces after gluing the saw cut edge of each. If a fine saw is used, the glue itself will suffice to fill the crevices of the saw cut. The picture at the back is simply a guide, like a dissected puzzle, to assist in replacing. I should work the whole on a piece of glass to ensure a level surface, and put all the pieces in the back.—J. G. W.

American Organ Building.—W. S. J. (*Wandsworth*).—I have already sent in the first of my papers on American organ making, and it will appear as soon as arrangements can be made for commencing the subject. "The American Reed Board Agency," No. 2, Oseney Crescent, Camden Rd., N.W., will supply you with fittings. Write for price list.—G. N.

American Organ and Harmonium Building.—Vibrator.—See answer to W. S. J. (*Wandsworth*).—G. N.

Bellows for American Organ.—Organ.—See answer to W. S. J. (*Wandsworth*). The construction of the bellows will be fully dealt with in the first and second papers on "American organ making."—G. N.

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Harmonium.—A BEGINNER.—It is impossible within the limits of this answer to give sufficient instruction to enable you to make a harmonium with two sets of reeds. If the Editor sees fit, I may possibly give a series of articles on the subject at some future date. But why not make up your mind to construct an American organ? It would prove a most interesting task, and papers on the subject will appear shortly.—G. N.—[At some future time.—ED.]

Organ and Harmonium Building, Book on.—SPECTATOR.—I do not think there is any work on American organ and harmonium making and repairing published. I have never heard of any book on the subject.—G. N.

American Reed Organ.—SWANG (*Scotland*).—The peculiar characteristic of the American reed organ is its sweetness of tone, and it is undoubtedly this feature which has made it such a popular favourite in this country. It would be difficult to name the principal makers without giving the whole list, as they all claim to be the best in the market. The best English organs are quite as good as the best American, and will generally last longer. I can supply you with the name of a good maker if you write to me through the Editor.—G. N.

Preparing Vellum.—PERSEVERANCE will find all his queries answered, at as much length as the limits of "Shop" columns will permit, in a recent reply to PUZZLED under the above heading, which appeared in No. 25, page 397.—M. M.

Leather for Concertina Bellows.—CONCERTINA.—You will get all the materials for concertina bellows from Messrs. Wallis & Son, Euston Road, London, Messrs. Kohler & Sons, Edinburgh, or through any music-seller who cares to order them for you.—H. D.

Hardening Steel.—TANCRED.—Please read carefully the remarks about working steel in article on "Swords," and try to fancy that there is a sort of law-governing inorganic matter which workers must be guided by. For instance, if you hammer one part of your tool much while cherry red hot, and another part much while black hot, you produce unequal tension of fibre of the steel; if you leave it to be chilled on the shop floor, this again affects the fibres—molecular structure is the scientific term. To heat a chisel thus damaged in the grain, and to chill it for hardening, and heat it again for tempering in that state is to ensure a twist in a flat thing, or a crook in a round thing. Follow the direction about heating and drawing sword blades if you forge your chisels. If they are forged already you must take the chance, but use a muffle—an old bit of iron pipe makes one—pack chisel with charcoal dust; when red-hot, pass it into a brine bath that has an inch of linseed oil floating on the top of the water, but the simple water bath ought to serve in most cases, if the steel has been fairly well worked, to make the chisel.—J. C. K.

Wood Carving Tools.—A. W. P. (*Leytonstone*).—Six cutting tools would be sufficient for carving wood picture frames: 3 gauges, a primer, and 2 narrow flat chisels. Most good tool shops keep an illustrated price list of Addis's carving tools, and by inquiring at one you could see at once the kind of tools you are likely to want.—F. M.

Hydraulic Motor.—C. G. O. (*Truro*).—Room cannot be spared in this department of WORK to give you a useful detailed account of how to make a hydraulic motor. I should advise you to fully study the subject by the aid of the lessons on hydrostatics in "Cassell's Popular Educator," and by reading such works as Mahan's "Water Wheels or Hydraulic Motors"; Donaldson's "Water Wheels"; or Cullen's "Practical Treatise on the Turbine." Any of these books can be obtained from Mr. Calvert, 29, Great Jackson Street, Manchester, if you cannot obtain them through your local bookseller. You may also learn much concerning the various types of hydraulic motors now in use by studying the illustrated catalogues of Messrs. W. H. Bailey & Co., Hydraulic Engineers, Albion Works, Salford, Manchester. Their little water motors are the pink of perfection, but you must have the water delivered to them at the right pressure to work them properly.—G. E. B.

Magneto Electric Bell.—NORTH (*Newcastle-on-Tyne*).—The generator for a magneto electric bell is simply a small magneto-dynamo with its armature wound with very fine wire, and made to revolve at a high rate of speed in the field of a powerful magnet. You may get such a machine from Messrs. T. Gent & Co., Braunstone Gate, Leicester. Space cannot be spared in "Shop" for a detailed and an illustrated description enabling you to make one.—G. E. B.

Improvement of WORK.—H. P. (*Kilmarnock*).—I am obliged to you for your kind suggestions about a cover, but as all these things naturally occur to us here as well as to readers in all parts of the country, I can assure you that all these matters are carefully considered and adopted if found to be feasible.

Eiffel Tower.—OHIO.—Reliable sketches of this structure will be found in the *Illustrated London News* and *Graphic*, if you search files of these papers.

Boat Building.—OHIO.—I cannot say with any certainty when papers on this subject will appear. As yet nothing has reached me, although I have been promised articles on building steam launch, canoe, etc. It will give me the utmost pleasure to redeem my promises on this point, when contributors who have undertaken to write on the subject enable me to do so.

Coal Mining.—COLLIERY DEPUTY.—I am afraid it will not be possible to go into coal mining in WORK, at all events just at present, in such an exhaustive way as you seem to require, but whenever any paper is sent me on improvements on the system at present in use, and on the appliances used, it shall be carefully considered with a view to insertion.

Kaleidoscope.—A. H. C. (*Birmingham*).—You must kindly bear in mind that the writer of the paper on his newly invented kaleidoscope is a busy man, and has but a very limited time for writing. His second paper, illustrated with very elaborate engravings, and his third paper also, have appeared before this reply meets your eye, because at the present moment it is simply impossible, owing to the demand for replies in "Shop," to find room enough to satisfy querists immediately. I greatly regret delays, and can only say that means of relieving the congestion are under consideration.

Bees and Hives.—J. J. B. (*Darlington*), BEE KEEPER, and other correspondents.—The series of papers on apiarian appliances, which I have now in hand, will include instructions for making hives, extractor, etc.—APIS.

Frustum of Cone.—CUBICAL CONTENTS (*Willesborough*).—Calculate the contents of the whole cone, and deduct the top. The rule is, divide the difference of the cubes of the two diameters by the difference of the diameters simply, and multiply the quotient by the height and by 0·2618. The cube of 11·5 is 304·625, that of 7·5 is 421·875, and the difference of these cubes is 265·75, which divided by 7 (the difference of diameters) gives 37·25, which multiplied by 0·2618 and 10 (height) is equal to 97·4 cubic inches.—F. C.

Engraving on Metal.—COUNTRY WATCHMAKER.—Articles descriptive of engraving on metal copiously illustrated are in my hands and will shortly appear. You must kindly bear in mind that where so much has to be done comparatively within narrow limits, it is not possible to deal with everything at once. Nor is it possible to give immediate answers to queries, owing to the great pressure on the space allowed, which is the utmost that can be given at present, and the necessity that exists for going to press some time in advance of publication. An answer has been given to your previous query on this subject, but the appearance of the answer in WORK depends, as I have said, on the space at command.

Printing.—T. E. N. (*Islington*).—Your letter contains a proposal to write a series of practical articles on this subject. It requires an answer by letter. You give your address, it is true, but append initials instead of full signature. Please write again giving name.

Gardening.—F. J. L. (*Chumleigh*).—It will not be possible to give directions either weekly or monthly for operations in the garden in WORK. There are many papers specially devoted to the subject, and then again there is Cassell's "Popular Gardening," a complete and exhaustive work, touching on every branch of the subject, which by-the-by might purchase with advantage, and which, if such a course be desirable to you, you might acquire by degrees, as it is published in monthly parts as well as in a complete form. WORK is a Magazine mainly dealing with construction and decoration. Appliances used in gardening come within its scope, but not the routine work of the garden.

Icing and Piping Cakes.—H. G. (*Paddington*).—You ask if I "have any idea of giving a few lessons on the ornamentation of cakes, technically called in the baking trade 'icing and piping,'" and you remind me that I "promised to give all kinds of work attention." It is true that I did so promise, but although WORK is a Magazine that treats principally of construction and decoration, there never was any intention of going into the construction and decoration of cakes. Moreover, if I mistake not, there is a special trade paper in which such subjects, I should think, would be fully and properly treated.

Model Ship.—J. B. W. (*Wolverhampton*).—There is so much pressure on the space allotted to descriptive papers and articles, that it is not possible to go into Model Shipbuilding, at all events at present. The best book you can have on the subject is "Model Yacht and Boatbuilding," published by Gill, 170, Strand, London, price 5s.

Glass.—W. H. (*Ravenstall*).—To bore holes in glass use an ordinary drill, lubricating with turpentine and camphor.

Polishing Hall Chairs.—M. F. (*Balham*).—The best and most satisfactory way, if you are able to manage it, will be to re-polish your chairs entirely, cleaning and washing them well first. If the present polish is very bad it will be well to remove it by scraping, or with methylated spirits. So much depends on the condition of the chairs that without seeing them it is impossible to advise you definitely. Very probably a polisher might be able to renovate them by just touching up the defective parts with a rubber charged with polish in the usual way. Whichever course you adopt remember that no filling will be required, as the grain is already stopped. For the rest the process is just the same as if the chairs were "in the white," that is, unpolished. If the discolouration in the seats is caused by grease your best plan will be to scrape them, but from the doubt you imply as to the cause of this, I am almost inclined to think it may be owing to the natural darkening of the wood, in which case you need hardly try to remove it. By looking underneath you will probably be able to decide whether the discolouration is natural or not. You might lighten by washing with a solution of oxalic acid in water, after removing the polish, but you are more likely to do harm than good. If the marks are so conspicuous as to be an eyesore, suppose you darken the rest to match by mixing a little suitable colouring matter with the polish, or by staining, if you should be unable to get a deep enough tint without.—D. A.

Drills.—AMATEUR (*Edgware Road, W.*).—I am afraid you will find it useless to attempt to make these, as they can be bought so cheaply, and you are evidently not accustomed to the work. The material used is steel, which you can get of suitable quality and in quantity from Aird & Anderson, Whitechapel, Liverpool. After shaping the ends they must be brought to the proper degree of temper; so you will see as, you are only wanting a few drills, that the game is not worth the candle.

Blueing Gun Barrels.—AMATEUR (*Edgware Road, W.*).—This work is quite unsuited for an amateur. The barrels are prepared by oiling, and then placed in a chamber or receptacle where they are heated to a certain degree.—D. A.

Copying Apparatus.—W. C. B. (*Queenboro'*).—The process you ask about is evidently one of the "graphs." Any stationer will procure you the apparatus as well as the special ink required, but if you prefer to make it you can easily do so. The main ingredients are gelatine and glycerine with a certain amount of water, but to these several other ingredients are often added. For a few copies you will find ordinary glue melted as usual and a little glycerine do very well. The glue alone soon dries, and the glycerine is added to keep it moist, so you will see that proportions may be altered according to circumstances. I never use anything but the simple mixture, which can be re-melted whenever required, and a little more of either glue or glycerine added as desirable. The ink I always buy ready made as it is better, though it may be prepared by dissolving some aniline dye—purple is the best—in hot water. You will find the following a very good way of making a "graph." Soak some gelatine, obtainable from any grocer, or fine glue, in cold water till it becomes quite soft, and having poured off the surplus water melt it with heat. Take care not to burn it by placing the vessel directly on the fire. When quite melted add glycerine in about the proportion of four to one of the solid gelatine, and thoroughly incorporate by stirring. Pour the mixture into a shallow tin tray, such as the lid of a biscuit box and leave it till cold, when it is ready for use. Be careful to avoid the formation of air bubbles, which must be removed before the composition sets by pricking them. You will also find the following a reliable recipe, though more complicated:—Gelatine and sugar, 1 part each, 2 parts sulphate of barium, 4 parts water, and 6 parts glycerine. If you mix more than is required to fill your tray keep it in a tin canister for future use. After a time, what with washing off ink after printing and general deterioration of surface, the compo in the tray ceases to give good copies. It should then be scraped off, and re-melted either alone or with some of the fresh stuff with the tin, by letting this stand for some time in hot water. By this means you can use the compo over and over again. After using wash the surface over with a soft moist sponge to remove the ink, and when not in use keep the composition covered, both to keep it free from dust, and to prevent evaporation of the moisture.—D. A.

Copper Plating.—MINER (*North Wales*).—To copper plate with pure copper a number of large copper plates you will require a large vat filled with a solution of copper sulphate, a number of copper plates to be used as anodes, and a strong current of electricity obtained from very large battery cells, or a large electro-plating dynamo, the last being preferable. Before I can give you efficient advice, I must know the size and number of the plates to be coated. It will also be well to let me know whether you have access to a plating dynamo or not, and also what motive power you have at your command. If you do not know anything of the art, you should get a book and learn first how to deposit copper. Space cannot be spared in "Shop" for a full description, but the subject in all its details will be treated in WORK in a series of articles.—G. E. B.

Prints Transferred to Wood.—G. W. (*Chester*).—You must be prepared to encounter disadvantages if you seriously intend to pursue your idea of transferring prints from paper on to wood panels. (1) If you succeed in obtaining a satisfactory result the whole thing will be only a reversal, which will, in figure subjects, be very ridiculous. (2) The paint which you use for the experiment will be irretrievably ruined. I have heard of a plan, but cannot vouch for its efficacy as I have not tried it; it is to saturate the paper on which the picture is printed, with tartrate of potass; then to pass a printer's roller charged with ink over the face of the print. The preparation of the paper is supposed to enable it to resist contact of the greasy ink, leaving the lines of the engraving fixed to receive it, and to transmit impressions. My reply to J. G. in No. 23 bears also upon this subject.—J. H. W.

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Filter Bed for Conditioning Yarn.—W. B. (*Bolton*). — There are many forms of filter beds, or damp cellars, as they are called, but I will give the one that has given the best results out of many I have had to do with. It is rather an awkward thing to advise on, unless one could see the situation or the condition of things as they now stand, and I would suggest that persons asking questions that certain conditions would alter, should give the fullest particulars when asking the question. But to the question on hand: the first thing to do is to determine the floor line, then dig or clear out the soil to a depth of 2 feet below the proposed floor line. Should you now come to a good solid bottom of clay, you can commence to construct the bed, but should the bottom not be clay, or not a good clay bottom, then you must go 4 inches deeper. When that is done, you must puddle 4 inch of clay in, and level off, and lay in drain pipes to be connected with a pipe to the lodge. You will then lay in 6 inch of round stones, such as you see in brook beds. Should you get them from a brook, they must be washed before putting in your bed. They should be riddled with a riddle of 1¾ in. mesh, and the smaller ones that go through will be wanted later on. You now put a layer of sand about 1 inch deep, then comes the smaller pebbles or stones 3 inch deep. You now put 1 or 2 inch deep of charcoal or gas carbon, that can be got from the gas-works. You lay on 7 inch of sand, and the bed proper is made. You now put a brick floor on the sand, and the bricks must be put on their edge and laid half an inch apart from each other all round. You put fine pebbles, that have been washed, in the spaces between the bricks. You can now lay on your water supply, which must be a slow but constant one, at distances 16 ft. apart, and regulate the water so that you always have the top of the bricks level with the water. You will soon find out how to get at that. Should there be anything more you wish to know, ask.—J. W.

Gilding on Gilt Mounts.—L. M.—Gilt or bronze mounts are made by using good glue free from grit, which is spread evenly upon the card or surface to be gilt, and bronze powder dusted on through a sieve. It is a dangerous process to health, and I would advise the amateur to buy his boards ready bronzed. He will find it cheaper.—G. R.

Rust on Pianoforte Strings.—CHEVIOT wishes to know how to remove the rust from the strings of his piano. Take out the front or top door, also remove the bottom door, under the keyboard. Then unfasten the buttons, and pulling the action forward, lift it out carefully, then you will be able to get at the strings. Now provide yourself with a piece of soft leather, one penny worth of flour emery, and a little paraffin oil. Slightly damp the leather with a few drops of paraffin, and sprinkle on the faintest suspicion of emery; rub up and down the steel wire. Do not touch the copper strings at the bass, except the ends which are steel. The rust on the coils round the wrest pins should be removed with a strip of leather put round the coils, and pulled up and down. Serve the bolt-heads in the same way. To prevent a recurrence of this, pulverise some camphor in a little lard free from salt, put a little on a piece of leather, and rub over the strings. Also see "Hints on Preservation of Pianos," in No. 9 of WORK.—T. E.

Photographic Lens.—R. C. D. (*Aberdeen*).—You ask for a "tip" as to the making of a lens, and though I could throw my reply into the form of a *résumé* of the common process of grinding such a lens, I am sure that the reply would be of little practical value to you. For two or three shillings, Lancaster, of Birmingham, or any maker of cameras at popular prices, would sell you a lens that would be exactly what you want, and which it would take years of patient labour on your part, if I understand your letter rightly, to learn to make. Practically this is the best information I can give you. Evidently your idea as to the "various kinds of glasses, and how they ought to be placed in the tube," is of the simplest degree, and consequently any discussion with you as to the construction of a complicated photographic lens would have to be begun at its most elementary optical stage.—E. A. F.

Sign Writing.—F. W. B. (*Bristol*).—The specimens of old English lettering given in No. 19 of this journal were drawn expressly for publication in WORK, and taken from the best available source. The example sent by F. W. B. is not true old English, but a cross between the old black letter and Anglo-Saxon. The formation of the various alphabets vary in almost every town in the kingdom, and each writer forms his letters according to his own individual taste. Controversial matters of this sort, however, do no good to any one, and I must decline to enter into them with F. W. B. At the same time, I am always willing to answer a plain and practical question. As to the £10 per week, there are many men in town who undertake the best contract work who earn more than this even, but, of course, 30s. is nearer the mark in the case of the ordinary country journeyman. It is, however, to the former ideal I hope to see the industrious student reach. The remarks about amateurs and outside competition is "baby's talk." It is the same in all trades, and nowadays it is simply the "survival of the fittest." If F. W. B. intends to insinuate I am writing for amateurs, he is mistaken, as I do not consider it work an amateur is likely to take up.—H. L. B.

Ink for Ticket Writing.—PARADOX (*Southport*). — The following is a good receipt: — Rub thoroughly together eight parts lamp-black, sixty-four parts water, and four parts finely pulverised indigo. Boil until most of the water has evaporated, and then add five parts gum arabic, two parts glue, and one part extract of chicory. Boil again till the consistency of paste, then run into wooden moulds that are rubbed with olive oil. It is the addition of too much gum arabic that causes the ink to crack on the tickets.—H. L. B.

Mounting Pictures.—J. T. (*Burton*).—The best method, and one always adopted by good photograph mounters in the trade, is as follows: Damp your photograph upon clean glass face downwards, and starch the back evenly, which is prepared by putting, say, six pieces of best white starch, procurable from any respectable oilman, in a basin and mix to a thick paste with cold water, then pour sufficient water—must be boiling—to form a thick paste, and use when cool. Paste is fatal to photographs; when starched lay upon your card, and rub down with blotting-paper, and you will have it dry for use in five or ten minutes.—G. R.

Wood Mitre Cramp.—J. H. (*Blackburn*). — I cannot advise you with respect to making a wood mitre cramp. As a sort of substitute, I should suggest placing a cord round the frame when glued together, and laying on the bench, placing a piece of round wood like a hammer handle, and twist it up tight as you please. This is the best method I could devise, but perhaps some brother amateur on reading this will give you his experience of making a more practical home-made mitre cramp.—G. R.

Polishing Mahogany. — J. M. (*Glasgow*). — Some papers on polishing are in the printers' hands and will soon appear. Replies to all queries submitted are obtained as speedily as possible, and are then handed to the printers to be put into type for appearance in WORK. Owing to its very large circulation, each number of the Magazine goes to press considerably in advance of its date, and hence it sometimes appears that an unreasonable time elapses before the inquirer gets his answer. If you could pass a week in the Editor's office you would find that everything that can be done to expedite matters is done.

Continuous Fountain in Small Aquarium.—J. M. (*Glasgow*).—Fountains must be supplied from a height considerably above themselves. Thus, supposing the aquarium to stand on the floor of a room, the cistern which serves as the source of supply should be somewhere near the ceiling. The fountain will work as long as there is water in the cistern, and the continuity will depend, therefore, on the maintenance of the supply.

Dulcimer.—GRANDFATHER.—A series of papers, conveying instructions for making dulcimers, will be commenced shortly, and in these will be given information on every point on which you ask assistance. It will be useless to go over the ground twice, first in a detailed reply to yourself, and then in the articles.

Cock, How to Grind in.—S. G. (*London, S.E.*).—To grind in a cock, take out the plug and wipe off any grease that may adhere to it, and after dipping in water, sprinkle a little burnt sand on it. Now insert the plug in the shell of the tap, and turn it backwards and forwards, but be careful not to put pressure on the plug when turning it back. Take the plug out occasionally, and sprinkle more sand on when required, and continue this until the plug bears equally all round, which will easily be seen by the appearance of the metal. Finish off with a little whiting and water. Finely powdered Bath brick may be used if the sand is not procurable, but on no account use emery powder, as it cuts the metal.—T. W.

Disinfecting Books.—J. M. (*Edinburgh*). — Sulphur fumes will make an excellent disinfectant for books, but in using it you must not subject the books to any degree of heat, as the heat will spoil the binding. Leather-bound books will crack, and cloth will blister. It will be best to put the books in a box, and carry the fumes from the burning sulphur through a pipe into the box. The arrangement of the box, etc., will be an easy matter. After disinfecting, it will be well to wash the binding over with glaire—*i.e.*, white of eggs beaten up until quite thin. If you had stated the style of binding of your books, I could have given more definite information. Querists should be explicit with their questions, as it is sometimes difficult to get at what is really wanted.—G. C.

Cloth Binding, Restoration of.—ANTHROPOS.—It is impossible to restore cloth covers of books that have become faded through use. Bookbinder's cloth is never washed, for the simple reason that washing spoils it. The best way to restore cloth-bound books is to re-bind them. The information necessary for doing this is forthcoming in the pages of WORK. In the meantime you may freshen them up a little by coating them with glaire—*i.e.*, the whites of eggs beaten until quite thin. Do not attempt to dye the covers of your books.—G. C.

Book Cover, Best Material for.—W. H. B.—The best material for a book cover, whether it be red, green, or blue, is morocco. If the book is a small one, let the skin be as thin as is consistent with strength. The materials used for binding depend very much upon the nature of the book and the taste of the owner. I should have preferred a little more information in this respect than your query contains.—G. C.

Re-painting Clock Dials.—G. C. H. S.—There is no more difficulty in doing this than in engraving a dial, or painting the name on one. The chief thing required is that you have had practice enough beforehand to obtain some skill with your tools. You say you use a spirit varnish. If you mean a paint made with colour and varnish, such as Brunswick black or Aspinall's, then you should be able to get the fine lines all right, providing you have a good brush, and that you know how to draw or paint sufficiently well. For your present job, you might try and get a steady line by using a ruler to guide your pencil; but, after all, painting dials is a special line, and here in London they can be sent to a clockmaker's material shop, and they get it done. However, there is no reason why you should not paint a dial yourself properly, but you must practise first, and if you study Mr. Benwell's papers on Sign Writing, you will get a good many hints as to materials, etc., for really it is very nearly allied to a sign painter's job, is'nt it? Now, as to the solution that you have seen used to clean gold and silver work when tarnished by fire, it is composed of 1 part sulphuric acid, or vitriol, as it is also called, and 30 or 40 parts water. The same proportions of nitric acid (aquafortis) and water (1 in 30 or 40) are sometimes used, but the first here given is the best. They are usually known under the names of "vitriol pickle" or "nitric pickle" in the workshop.—H. S. G.

Colouring Small Bed-room.—J. C. (*Holloway*). Nothing is too trivial for "Shop" to reply to, providing a useful and reasonable question is asked. You say you understand making white-wash; then so also do you the making of blue-wash. Perhaps, however, your plan and the house-painter's may scarcely be identical, so I give you brief instructions on the mixing. Respecting your "unwelcome guests," a room so inhabited should have every particle of wall-paper stripped off it, and everything washed off the walls with hot soda-water until the plaster is quite clean. If the trouble is confined to certain spots, saturate the parts well with carbolic acid, or petroleum is useful. If general, give the walls—after all holes and crevices are stopped with plaster-of-paris—a coat of strong patent, or glue, size with some carbolic acid or turpentine in it (about 1 gill to 1 gallon of size). Then, for finishing coat for light blue or grey walls, you will want, say, 14 lb. whiting, say 6d.; 1 lb. of glue, 6d.; and ½ lb. lime blue powder, about 3d., total 1s. 3d. Put the glue in 1 quart cold water, to soak over night, and when soft, stand over the fire until dissolved. If you can conveniently get ordinary double size, it is the simplest; 4 lbs. of this is necessary, and the cost about 4d., and it will only require dissolving with a little water added, but don't make it very hot. Put, say, one quart cold water into a vessel, then the whiting into it. When the latter is soaked and soft, pour off water from the top and put in the lime blue, well mixing with the hand or a stick. When the two are thoroughly incorporated, add the quart of warm size or diluted glue; thoroughly mix the lot, and then it is ready for use. Remember that all colours made from whiting dry nearly half as light as when wet; also that the distemper, or colouring, works best when cold. A half-pailful should do a small bedroom.—F. P.

Canvas and Cardboard for Painting on.—V. N. (*Manchester*).—I am not certain of the precise proportions of the paint with which the working side of canvas is covered, but it could be prepared without very much trouble, I believe. In the first place, however, the canvas, as it is called is made specially for the purpose, free from roughness and uneven surface. Again, the manufacturers do not coat it with a brush, as you or I should have to do, but the white paint is rolled on—hence, freedom from brush marks, and a perfectly distributed coating. The cost of good prepared canvas retail is about 2s. 9d. per yard of 27 in. wide, and so on in proportion to width. You will, therefore, see that, by the time you have bought the special fabric, purchased your materials, and accomplished your purpose, you would not effect much saving—in fact, the mounted canvases can be bought at so reasonable a price that I do not believe it would pay to prepare one's own, either in small or large quantities. Presuming, however, that you have a piece of canvas, or any similar fabric, it would require to be stretched, if only permanently, and then coated with strong, warm patent size. When thoroughly dry, one good coat of paint made from white lead and light copal varnish, well mixed to a stiff paste, and then diluted with turpentine to a consistency which we can spread freely, would give a non-absorbent surface suitable for oil-painting. Whether the amount of "body" the one coat contained would be sufficient to fill up the "grain" of canvas is, of course, entirely dependent upon its degree of texture. After spreading the colour generously with the brush, you would have to stipple it with a large tool to properly distribute the colour, or, better still, cover a paperhanger's roller with cloth, and roll the colour over quickly and evenly. Winsor & Newton, the royal artists' colourmen, make a prepared "Academy" board which is non-absorbent. It has a good hard and smooth surface, and appears only to be rolled with one or two coats of "flat" paint, such as above. If your boards are of a cheaper kind, and rougher and more porous in surface, you might with advantage give two good coats of size previous to painting. The paint can be stained to any desired colour, so long as little or no oil enters into the mixture, in which case you will get too glossy a surface, and it will not harden so well.—F. P.

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Care of Bellows.—WHEELWRIGHT.—The proper way to keep your bellows in good order is to fill them with air, then chain the top up, leaving the bellows distended until you wish to work them. If they are new do not oil the leather, as it will only harden and cause the leather to be stiff. Dust the bellows often, especially in the crevices, as fine ash or grit settles in and causes the leather to wear into holes. In some shops they only suspend the bellows at the week end and holiday time, also dusting it often. Others leave theirs down, occasionally dusting it. The consequence is that the creases in the leather caused by constant pressure is the weakest part in the bellows. I presume the long bellows you have bought are second-hand ones, as those who now go in for new bellows buy the circular ones, as they are easier fixed and take up less room. If your bellows have been oiled and the leather is stiff, chain the top up and give a thorough good dusting, then wash the leather several times with warm water. When dry rub the leather well with dubbing made from the following recipe:—Get ½ lb. of tallow and melt it, then pour in the tallow 1 pint of train oil. Mix well together. Another recipe equally as good:—Get ½ lb. of mutton suet, melt in an earthen pot in the oven, then pour through a sieve into a large pot. Into this liquid fat pour 1 pint of raw linseed oil, and mix well together. In cold weather this dubbing should be warmed before using, and can be applied with a brush or a flannel rag. If the bellows are used from Monday to Saturday it can be cleaned and dubbed every twelve months.—W. P.

Small Lathe for Bench End.—E. W. M. G. (*Malvern Link*).—What use do you intend putting the lathe to? If you wish to turn pieces about the size of the first joint of your thumb, a lathe 8 inches long might do it, but for a larger piece of work it would be quite useless. However, I would be far from discouraging you, and, by all means, make a lathe, but let it be longer than 8 inches. Such a small thing, except after the manner of a watchmaker's throw, would never pay for the time spent on it. Why not make a lathe the whole length of the bench, and so that it could be removed when not wanted? something like the first I described in "Lathes for Everybody." If you make the heads of that very microscopic, it might be confined to a space 8 inches long. Although I am not the writer of the reply, page 332, WORK, yet I may be permitted to suggest that the table E E could be attached to a separate pillar and not to the guides, D, to which it appears to be fastened in the drawing. The pillar could be made in two, with a joint which could tilt the table, or a semi-circular piece of metal could be attached to the under side of the table with slots in which the fastening screws would work. It is not easy to make a tilting table which acts really well and scientifically.—SELF-HELPER.

Clocks in Fretwork Cases.—YOUNG CLOCKMAKER.—I am sorry to say that I do not understand your details at all. I gather you want to know if your cases are large enough to take chime quarter movements. To that I can say "yes, plenty," an ordinary chime movement being about 8½ by 7 by 4 bells in height, extra say 3 inches, and now beyond this I am fogged, as I do not see what you want mitre wheels on pin wheel and centre wheel, as these trains are made in the usual way, with a third train added generally on the left for the quarter work, and all three trains being inside the plates; but if you have never seen a chime quarter clock, let me advise you to get Britten's "Watchmaker's Handbook," as on page 259 there is a good drawing half full size of a movement showing all the dial work, etc., and trains, and on page 258 giving full details of trains, etc. The book consists of 384 pages of useful matter to all interested in watch or clock work, whether young or old, amateur or professor; the cost is 5s. If you cannot afford one, I will lend you mine for a week to copy out the necessary matter if you will pay postage both ways and return it.—A. B. C.

Sideboard.—A. J. (*Ingrow*).—Certainly, you are quite right to put any questions on matters coming within the scope of WORK to us, and I trust you, like many others, may derive increasing benefit both from answers and articles. We cannot, however, undertake to reply privately as you suggest may be done to you, the "Shop" columns being intended not only to help individual inquirers in any difficulty that may occur to them, but to be of utility to readers generally. I am glad you send sketches, for however rough they may be, drawings are of great assistance in enabling a suitable reply being given. It seems almost a pity to make such a piece of furniture as the sideboard of pine, but your reason for doing so is certainly a cogent one, and there is no reason why a pine job should not be sound and good. I certainly should not advise you to paint and grain it. This finish, which in any case I am not fond of, would make your sideboard suspiciously like a common kitchen dresser. If you must paint it, let the finish be plain—*i.e.*, ungrained; but I would much prefer the alternative of staining and French polishing. I am not sure whether you do not contemplate marking (or graining) with stain. In thoroughly practised hands this may occasionally be to a limited extent, allowable; but the effect is rarely good, as work so finished has generally a common tawdry appearance, especially when done by any one without great experience. The carved trusses under the drawers can be bought; but I do not think you will find them any improvement on some more simple ornamentation which you could make up yourself. They are, in fact, rather tawdry than otherwise. You might, for instance, substitute a flat or turned half pilaster planted on the doors. A flat pilaster would look better if finished with a few beads or flutes, either of which you can easily manage with the aid of the scratch described in No. 7 of WORK. The same tool you will also find useful in ornamenting the drawer front, which I think, you had better make flat instead of curved, as shown on your sketch. This, however, is more a matter for your personal consideration, and you will, of course, to some extent be guided in the details by those of the small cupboards you intend to put on the sideboard. The two doors in the centre will do very well with looking-glass panels, but it is entirely a matter of personal taste whether you have them of this or of wood. Glass looks brighter and lighter, but generally the doors of sideboard cupboards have wooden panels. Transparent panels of course would only be used if you wish the contents of the centre cupboard to be visible, and unless they are ornamental you would not want them to be seen. A suitable length (provided the space is sufficient) for the sideboard will be 6 ft. It may, however, be made as small as 5 ft. with the four doors shown. In anything under this you had better make it with only one in the centre, which should be wider than the ends. The depth from back to front on end of top should hardly be less than 1 ft. 8 in. for 6 ft. length. If it is shorter reduce depth say, 1 in. for each 6 in., down to 5 ft. If your room will take it, and you want plenty of cupboard space, these dimensions may be increased, as there is no definitely fixed rule of proportion, and those given are merely approximate. The height of top should be about, or a little more than, 3 ft. For the substance of the stuff I should say that 1 in. (in pine) will be best for most parts, panels, drawer insides, and such like being less. A good deal, however, depends on how you intend setting out the work, and I can only advise you generally. You may want a thick massive looking top all solid, in which case 2-in. stuff would not be too much, or you may prefer using a comparatively thin top lined up to give the appearance of thickness. In connection with this I need hardly tell you to study the article on lining up, which has appeared in our pages. You will also find the articles on artistic furniture, and jointing up of use in giving you many hints. I think you will find the appearance of your sideboard improved if you raise the cupboard a few inches on turned columns, instead of placing it direct on top as in sketch. The side brackets also strike me as paltry-looking, and you will find the whole look much better, and not involve a great amount of extra labour if you carry the sides up to the top of the small cupboard, finishing them off with a little carving or moulding to match that on the back of it. One or two shelves should be fitted, screwing them from behind and the inside of the cupboard. They will be useful for books or ornaments, and if you support them by brackets or columns at the corners, you will have a handsome piece of furniture. As a suggestion for you, and to make my meaning clear, a sketch is given, which, without going into details sufficiently shows the intention. Instead of turned columns to the shelves, these are shown with rounded corners, and supported by a small bracket. If there is anything else you want to know about as your work proceeds, send us word and we will do what we can to help you.—D. A.

Lathe and Joiner's Benches.—W. T. C. (*Dundee*).—Yes; both these subjects will be treated in due course.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Horse Power of a Windmill.—G. C. (*Nunhead, S.E.*) writes in reply to SCRUTINEER, see page 526:—"I send a simple formula for calculating this:—

HP.=Horse power.
V.=Velocity of wind in feet per second.
A.=Total area of sails in square feet.

$$HP.=\frac{A.\ V.^3}{108{,}000}.$$ "

Lacquer for Iron and Steel, etc.—J. H. B. (*Kingstown*) writes in reply to STEEL (see page 526):—"On page 525, No. 33 of WORK, STEEL will find under heading 'Brass Lacquer' a formula for making a varnish which is called No. 1. If to this STEEL adds some aniline blue, previously dissolved in a little methylated spirit, he will have a very fair blue lacquer, which may be applied with a soft brush. The articles before being painted over must be perfectly clean. By using other shades of aniline instead of blue any colour lacquer may be produced."

Brass Lacquer.—BRASSOLINE (*Glasgow*) writes in reply to STEEL (see page 526):—"STEEL wants to know where to get blue lacquer for tin toys, etc. He can get blue or green; there are different grades. I think grade K K is the best at this address. The name of it is Brassoline. The Frederick Crane Chemical Company, 22, Newhall Hill, Birmingham."

Tuition in Carpentry.—G. W. M. (*Westbourne Park*) writes in reply to AMATEUR (*Bayswater*), see page 302:—"You can obtain tuition in carpentering at the Anchor Institute, Johnson Street, Notting Hill Gate (opposite the Free Library), during the winter session, which lasts from September to March. If you write to the secretary he will afford you every information."

Trade Notes and Memoranda.

WE take the following from the *Journal of Chemical Industry*:—Glycerine is used in tempering steel and iron. The specific gravity of the glycerine may be varied between 1·08, and 1·26 at 15 degrees Cent., by adding water, according to the composition of the steel. The quantity of glycerine should be from one to six times greater than the weight of the pieces to be plunged into it, and its temperature may be varied from 15 degrees to 200 degrees Cent., according to the hardness of the metal. The harder the steel to be tempered, the higher should be the temperature of the glycerine. To increase the quenching power of the bath various salts may be added. Thus, when a harder temper is required, protosulphate of magnesia may be added in quantity from 1 to 34 per cent. of the liquid, or from ½ to 4 per cent. of sulphate of potassium. For a softer temper, 1 to 10 per cent. of chloride of manganese, and 1 to 4 per cent. of chloride of potassium may be added. The principal advantages to be derived from these methods are:—(1) The temperature of the aqueous solution of glycerine may be varied within wide limits, the boiling point of pure glycerine being 290 degrees Cent. (2) Owing to the fact that solution of glycerine dissolves most salts that are soluble in water, the quenching properties may be varied by readily dissolving in the bath such salts as suit the kind of metal to be tempered and the degree of temper required.

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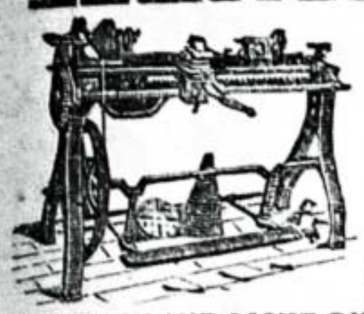

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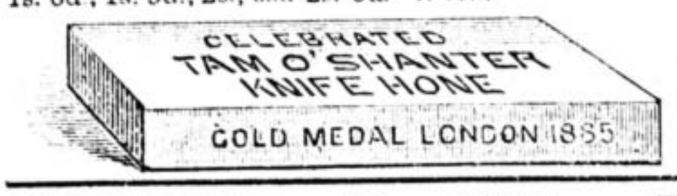

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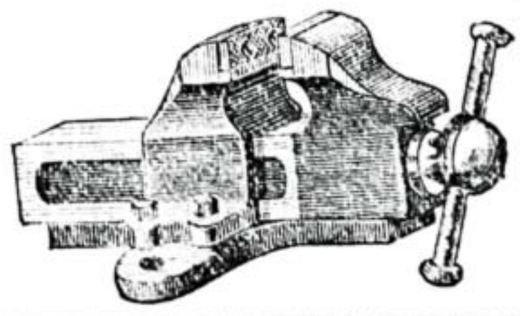

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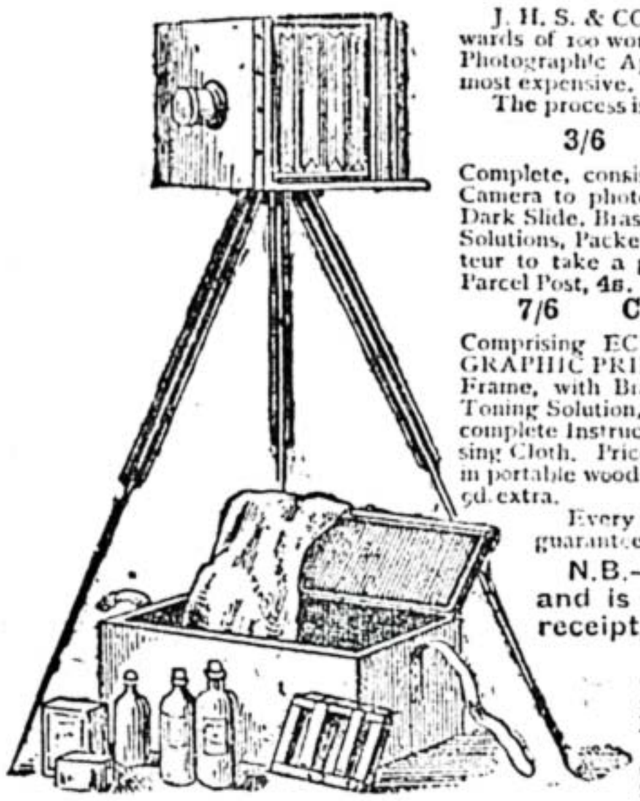

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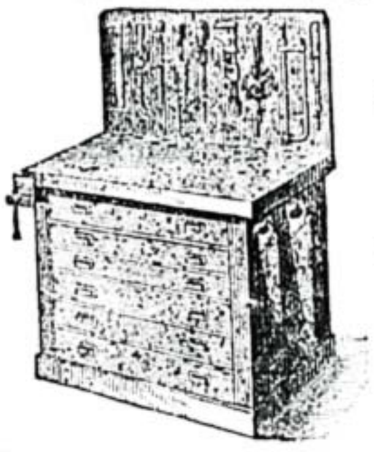

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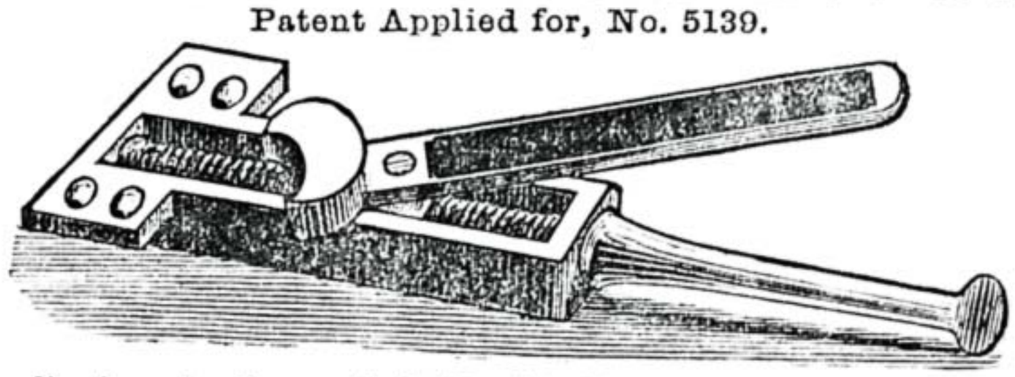

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